SOUTHERN RHODESIA.

REPORT

OF THE

Secretary, Department of Agriculture,

For the Year 1928

Presented to the Legislative Assembly,
1929.

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I have the honour to submit my report for the year 1928.

The year under review has been an exceedingly trying one for farmers. The lack of rain when it was most needed seriously affected the maize crop, and the difficult tobacco position has been a matter of much concern to growers. The lateness of the rains at the end of the year also caused heavy mortality amongst the stock. The question of feed and good water supplies for stock during the dry season or during periods of drought is one which might with advantage be given more serious consideration by cattle owners, as there is little doubt that this matter does not always receive the attention it deserves. The subject is not one which can be assisted by expert advice, as it stands to reason that land can only carry a certain number of animals per acre, and if land is taxed beyond its carrying capacity the result must inevitably end in heavy mortality amongst stock. The remedy to a great extent lies in making the best use of the natural pasturage and providing as far as possible supplies of good veld hay. The technical officers of the Department have for many years urged farmers to give hay more attention, and no doubt this has been done in numerous cases, but in many instances little provision is made, with the result that working oxen in particular get into a condition from which they can hardly recover. No doubt the last two seasons have brought the matter home to many farmers, and a little actual experience will do more to show the necessity for providing feed than endless advice on the subject.

The demand on the services of the technical staff increases yearly, and every effort has been made to distribute their services throughout the Colony. With the limited staff available, however, it is impossible to meet all requests for visits. It frequently happens that urgent requests are received from outlying farms for a visit from some particular officer, and if the request is not complied with, complaints are made that farmers are being neglected by the Department. It must be realised, however, that the staff have to cover a very large area, and are not always available to meet demands to visit individual farms at short notice.

The main object of the staff of the Department of Agriculture is to advance and assist the farming industry in every possible way, and if satisfactory progress is to be made there must be a feeling of confidence in the advice given by officers of the Department, and there must also be close contact and co-operation between farmers and officials. Without these the labours of officials in the technical branches of the Department are likely to prove of little value.

Suggestions or expressions of opinions will be welcomed, and the technical staff are only too glad to discuss any points with farmers. It is to be hoped, therefore, that the closest co-operation and collaboration between farmers and the Department will be maintained and if possible increased.

CROPS.

Maize.—The unfavourable season was responsible for a reduction in the yield of maize per acre, and although approximately 290,000 acres were planted to maize, as against 267,354 in the previous year, the production for the year was about 1,226,000 bags, as compared with 1,659,600 bags in 1927. The yield per acre was approximately 4.4 bags, as against 6.2 for the previous year. As stated, however, the season mitigated against the production of even an average crop, and considering the long spell of dry weather at a time when rains were most wanted, the yield per acre must be considered good, and shows that many farmers adopted methods to combat as far as possible by intensive cultivation and other means the lack of rain.

Sound and practical methods of maize growing can be seen at the Government farms, Gwebi and Matopo. The Agricultural Experiment Stations at Bulawayo and Gwelo also provide much helpful information in this connection, and it is unfortunate that these stations receive so few visits from farmers. New settlers who may have only recently taken up land could learn a good deal from these experiment stations in connection with the growing of crops, and established farmers might also obtain useful information by visiting the stations.

It is satisfactory to see that the "Farmers' Days" held annually at the Government Demonstration Farms are so well attended. At the "Farmers' Day" on the Gwebi farm it is estimated that over 250 farmers were present, and at the Matopo farm over 120 attended. These meetings do much good and give farmers an opportunity of discussing on the land the various methods of farming and provide a means for an exchange of views between farmers in different parts of the Colony. This all tends to promote and assist better farming, and the experienced and practical farmer can pass on much useful information to those with less knowledge.

The Rhodesian Maize Association continues to do good work, and has shown conclusively that the yield per acre can be doubled or even trebled by adopting sound farming methods. It would be of the greatest interest to all maize growers if those farmers entering plots in the maize-growing competition kept records showing the total cost per acre under the particular conditions obtaining on these plots, as compared with the general cost of production over the rest of the farm. It is realised that, for many reasons, the costs would vary considerably, but an average could be struck which would give a reasonably accurate average cost. Better farming methods are becoming more and more necessary, and every effort should be made to get the best possible yield per acre from all crops.

It is unfortunate that the practice of green manuring is not more generally adopted. There is no getting away from the fact that practically the only method of restoring fertility to the soil lies in green manuring, with the addition of suitable artificial fertiliser. The continual cropping of land with maize and the using of artificial fertiliser only must in time render the production of maize an uneconomic proposition. More use is now being made of kraal manure, but unfortunately in many cases insufficient attention is given to stacking manure, with the result that much of its value has gone before it is put on the land. The cost of providing suitable manure pits is very small, and the extra benefits derived from good manure would more than repay the outlay.

Ground Nuts.—The acreage planted to this crop was considerably less than that for the previous year, but there is every likelihood that in future years the acreage devoted to ground nuts will be considerably increased. Much, however, has yet to be done to get the crop grown on better lines and the yield per acre increased. Returns show that the average yield per acre is approximately eight bags, but, given more attention, the average should without difficulty be increased to ten or fifteen bags per acre. On the Gwebi Government farm the yield obtained was fifteen bags (of 75 lbs.) per acre. The question

of pressing the nuts in bales for export is being taken up, and it is estimated that the growers should get a remunerative average return for their crops, as selected nuts for the confectionery and pea-nut trades would probably fetch approximately from £20 to £30 per ton c.i.f. London, but great care would have to be exercised to see that the products for the confectionery and pea-nut markets are carefully selected and graded. Baled nuts for the oil trade would probably fetch about £15 per ton. There would appear to be no reason, therefore, why suitable nuts for export should not be extensively grown in Southern Rhodesia, but growers would have to make arrangements through some firm or co-operative company for the satisfactory marketing of the crop overseas, otherwise there is likely to be difficulty in disposing of the crop profitably. A reduction in railway rates has recently been granted for baled nuts, and 80 cubic feet per ton of 2,000 lbs. is now allowed, as against 50 cubic feet per ton allowed previously.

The growing and grading of this crop, however, must be given more attention if satisfactory returns are to be expected. A ready market for good nuts seems to be available, and, as stated, it is anticipated that increasing acreages will be planted. So far there has been little or no surplus for export, and local demands have absorbed the output.

Sunflowers.—The acreage planted to this crop shows an increase, but the yield is still low, being only about 4½ bags per acre. From this it will be realised that the growing of sunflowers has not been taken up seriously by farmers.

Tobacco.—The tobacco crop for the year 1927-1928 is estimated to be 24,201,201 lbs. of Virginian and 451,580 lbs. of Turkish leaf. Owing to certain returns not having been rendered by growers, these figures can only be taken as substantially correct. Seasonal conditions were unfavourable during the planting period, and lack of rain in certain areas when the crop was nearing maturity was the cause of a considerable reduction in both the quality and quantity of the crop. In spite of this, however, the total yield was much above that of any previous year.

During the year the Government arranged for the Minister of Mines and Public Works, and later for a special Tobacco Commissioner, to proceed to Great Britain with a view to assisting the tobacco industry of the Colony by bringing the Rhodesian-grown leaf more prominently before buyers and manufacturers. Much good work was done, and several new brands of all-Rhodesian cigarettes and pipe tobaccos are now on the market. Many difficulties had to be contended with, but the results obtained are highly gratifying, and there can be little doubt that the foundation work done will bear good fruit. It is only natural to expect that when any new country is likely to compete seriously with the supply of a commodity which other countries have controlled for many years, efforts will be made to keep the new competitor out of the business. In spite of this, however, the Rhodesian representatives have been able to obtain the good-will and assistance of well-known and influential tobacco interests overseas, and there is every indication that the demand for Rhodesian leaf will steadily increase. It is very necessary, however, that the supply should not to any extent out-strip the demand. On the other hand, care must be exercised to see that the supply is able to meet all demands, and it would be a serious matter for the industry if demands for our leaf could not be met. To prevent anything of this sort happening, close team work and co-operative efforts are essential. Whilst certain growers can no doubt dispose of their crops privately, the majority must look to their co-operative warehouses to dispose of the bulk of the crop. In every agricultural industry the necessity for a co-operative system for marketing crops is very evident, but it is only by loyal support that co-operative methods can give the best results, and this is a matter which rests with producers. That good tobacco can be grown in Southern Rhodesia there is no doubt, and there is little doubt that the efforts made during the year will result in an increasing demand for our leaf, but growers must be prepared to produce the class of leaf required and to market their crops in good condition.

The fact of the Imperial Tobacco Company establishing works near Salisbury is encouraging, but unless farmers are prepared to produce the article required they cannot expect this company or other buyers to purchase their crops, and no effort should therefore be spared by all growers to make themselves thoroughly acquainted with the class of leaf for which there is a demand. New growers must strive for quality of leaf, and they must study and adopt the best methods for picking, curing and grading their crops.

Cotton.—In spite of the set back experienced in cotton growing, this crop is now gradually being developed on sound lines, and although it may be too early to predict future results, there is no doubt that the prospects of breeding varieties suitable for many parts of the Colony are most promising. Much useful experimental work is being carried out by the representatives of the Empire Cotton Growing Corporation at Gatooma, where one or two varieties have given outstandingly encouraging results.

Increasing interest is being taken in connection with this crop, and it is hoped that cotton growing will yet prove to be an industry of some magnitude in Southern Rhodesia.

Wheat.—This crop continues to receive a fair amount of attention, and experiments are now being carried out by the Government with a view to establishing and breeding varieties suitable for the climatic conditions of this Colony. A good deal has yet to be done before any definite results can be obtained, but when suitable varieties have been established the crop will be more generally grown.

Crops other than those mentioned above are grown chiefly for stock feed or ensilage.

It is satisfactory to note that there is a steadily increasing demand for sweet potato cuttings, and this valuable feed for dairy stock and pigs is becoming more generally recognised and appreciated. Few other crops give a better feed value per acre, and it is so easily grown that no farm need be without it.

The total area under cultivation for summer crops for the year 1927-28 was declared at 389,824 acres, as against 346,776 acres for the previous year.

CATTLE.

The prices for slaughter stock have been well maintained during the year, and whilst they have not been high, they have, on the whole, been satisfactory. As in the previous year, there has been a big demand for dairy stock, but good dairy animals are not easy to find except at high prices. Dairy farmers naturally desire to retain their good stock, and unless they can get their price will not part with animals. Grading and culling is taking place in many herds, and the services of the Stock Adviser are constantly being asked for to assist in this work.

During the next few months it is anticipated that about 150 head of pedigree cattle will be imported from Great Britain. Of this number, about 50 animals are being imported by the Government for the Government farms at Gwebi and Matopo. The breeds being introduced on these farms are beef Shorthorns, Red Polls, Ayrshires and Jerseys. The introduction of these animals should lay the foundations of further good stud herds of useful breeds in Southern Rhodesia. In addition to the animals purchased by the Government, cattle owners throughout the Colony have taken advantage of the valuable assistance given by the Empire Marketing Board and the Government, under which the freight and railage of the animals are paid from London to Southern Rhodesia. The funds provided under this scheme allow for the importation of over 100 animals to *bona fide* owners free from freight and railage, and this is a very great consideration to importers. It is hoped that the scheme may be continued for further periods.

As promised by the Government, the Stock Adviser proceeded overseas to purchase animals for applicants, and from advices received first-class stock has been obtained.

The number of cattle exported during the year shows an increase as compared with 1927, and for the purposes of comparison the figures showing exports for the last four years are as follows:—

	1925.	1926.	1927.	1928.
Union of South Africa	9,591	12,250	7,244	10,369
For slaughter overseas (Imperial Cold Storage)	35,675	49,595	16,246	27,123
To England (on hoof)	236	310	200	140
Belgian Congo (for slaughter)	4,768	9,016	20,302	26,833
Belgian Congo (trek oxen)	383	—	—	—
Belgian Congo (for breeding)	9,269	2,829	1,340	5,701
Northern Rhodesia (for breeding)	85	32	219	411
Portuguese East Africa	538	614	1,347	852
	60,545	74,646	46,898	71,429

In view of the number of animals exported and the increasing requirements for local supplies, the prices for cattle are likely to rise during the coming year. There is already a difficulty in obtaining good cattle for fattening, and, as many more farmers are now stall-feeding animals, the demand for the class of stock desired is steadily increasing. It is unfortunate that so many good grade cows and heifers are sold for slaughter purposes, but the necessity for obtaining funds has no doubt been the cause of selling aimals which owners would have preferred to retain for breeding purposes.

SHEEP EXPERIMENTS.

For the reasons stated in my last annual report, the sheep experiments being carried out on private farms have not been a success so far as benefiting the sheep industry is concerned. It has been proved, however, that in many parts of the Colony sheep will do well, provided they receive proper attention and are dosed regularly.

The increase in the number of sheep in Melsetter district has justified the appointment of a part-time Government Sheep Adviser, who is resident in the district. By giving advice and practical demonstrations much useful work should be accomplished, and sheep farmers in the district will have the advantage of having a fully trained Sheep Adviser in their midst who will at all times be willing to assist in every way possible.

The Government are establishing sheep breeding stations at the Government Matopo farm, and also on the Rhodes Estate farm, "Timaru," in Makoni district. From these centres it is hoped to be able eventually to dispose of ewes and useful rams to farmers. At a later date no doubt pedigree sheep will be imported for the Government farms. In the meantime, however, good robust merino ewes and a good class of flock rams are more generally required.

On the whole, the sheep industry is making satisfactory progress, and within the next few years this industry should show a very appreciable advance.

REPORTS OF HEADS OF TECHNICAL BRANCHES OF THE DEPARTMENT.

As has been the practice for the past few years, the reports of the officers in charge of the different branches of the Department are appended hereto. As these reports deal fully with the activities of the various branches, it will only be necessary to write a brief summary thereon.

Chief Agriculturist's Branch.—The report of this Branch covers all matters relating to crops and agriculture generally, excluding tobacco, and deals with the work on the Government Demonstration Farms at Gwebi and Matopo. As the Stock Adviser will not be able to furnish a report this year, owing to his absence on duty overseas, matters relating to stock will be touched on under this section of the report. The Chief Agriculturist in his report gives his views on the question of non-success in farming, and amongst the reasons he gives are a lack of system and farming without a definite purpose. There is little doubt, although probably farmers will disagree, that there is a lack of system in many cases, and also that in other cases no definite purpose is aimed at. The position

is, therefore, that when seasons and crops are good and markets are readily available things go smoothly, but when adverse conditions arise the man without a system and with no set programme or purpose begins to feel the pinch. This is particularly applicable to the one-crop farmer. It has been previously stated that to be even moderately successful it is necessary to spread the risk of farming and not to concentrate entirely on any one crop. Numerous farms are probably found to be best suited for the growing of one particular crop, but by adopting sound farming methods and by supplying deficiencies in the soil there is no reason in many cases why the fertility of the land should not be increased to allow of general mixed farming, which would to a certain extent decrease risks in farming. As is stated by the Chief Agriculturist, the men likely to make good on the land are those with a clearly-thought-out and settled policy, and a determination to strive for a maximum standard of farming efficiency.

District agricultural advisers have been appointed during the year, and these officials should form a very desirable connecting link between farmers and the Department, as well as acting in an advisory capacity. The officers appointed have successfully passed through a course at Agricultural Colleges, and in addition have had practical experience in farming, and although their services may not always be desired by practical and experienced farmers, nevertheless they must be of great assistance to many farmers. However willing the Department may be to assist, little headway can be made unless farmers make the fullest possible use of those officers who have been appointed as experts in the different branches of the Department of Agriculture, and the district agricultural advisers can either advise or obtain advice for any farmer who may desire information on matters relating to any branch of agriculture.

It will be noted that the services of the Government Horticulturist have been much in demand during the year. This officer whenever possible gives demonstrations which are much appreciated, and fruit growers obtain much useful information therefrom.

During the year 178,000 cases of fruit were exported, as compared with 139,000 cases in the previous year. The prices obtained were high, and averaged about 25s. per case, as against about an average of 19s. per case for the previous season's crop. The citrus industry is steadily expanding, and several new growers have commenced operations on a commercial scale. New varieties of fruit trees, including Avocado pear and Pecan nut trees, have been obtained and are being tested in suitable localities.

The tea planting carried out by Messrs. Ward & Phillips, in the Melsetter district, has been extended, and the prospects of this crop in parts of the eastern portion of the Colony appear to be very promising. Coffee planting is also being carried out in various districts. It is too early, however, to report on the results, although on the whole the plants seem to be making satisfactory progress.

The results obtained from crops on the Government demonstration farms are detailed by the Chief Agriculturist, and, considering the unfavourable season, the returns from the different crops must be considered very satisfactory. At the "Farmers' Days" held on these farms the methods adopted in growing the different crops are fully explained, and interesting discussions take place at these meetings not only between farmers and the officers of the Department, but also between farmers themselves. These discussions are most helpful, and many useful and practical hints are circulated as the result of holding meetings of farmers on the demonstration farms.

It will be seen that the Friesland herd on the Gwebi farm has done exceedingly well during the year. The yield per cow in milk averaged four gallons, which is extremely satisfactory, and shows that a first-class milking strain of Friesland cattle is being established by the Government. It is hoped during the coming year to establish small pedigree herds of other milking breeds, including Ayrshires, Jerseys and Red Polls. A herd of pedigree beef Shorthorns will also be started, and the progeny from these herds should prove a valuable addition to pedigree stock in the Colony.

Excellent prices were obtained for bullocks fattened at Gwebi and Matopo farms for slaughter. The Government participated in the scheme for sending cattle on the hoof for slaughter overseas, and provided in all 31 head out of the total shipment of 140 animals. Only moderate prices were obtained for these animals, as unfortunately the high prices which had been offering a few weeks before were not maintained, and there was a considerable drop in prices when the Rhodesian bullocks were put up for sale. In spite of this, however, exporters were on the whole satisfied with the result of the shipment, and there is likely to be another shipment during the coming year. The freightage of £9 per head is a big item, and it is hoped that this may be reduced.

Sheep have not done well at Gwebi, but give promise of doing exceedingly well at the Matopo farm.

On both farms pigs have done exceptionally well. The breeds kept at the Gwebi farm are Middle Whites and Large Blacks, and at the Matopo farm Large Blacks and Large Whites are kept.

Farm costs are now being carefully recorded on the Gwebi farm, and these will in due course be published for general information.

At a later date it is proposed to carry out a similar arrangement of farm costing at the Matopo farm.

A few labour-saving devices have been tried at Gwebi farm, but so far nothing new of any actual value has been demonstrated.

The activities of the Agricultural and Tobacco Experiment Stations are fully dealt with in the Chief Agriculturist's report.

Dairy Industry.—From the report of the Dairy Expert it will be seen that farmers carrying on dairying operations have had a very trying season. The want of rain during the whole of February, and the lateness of the rains in the latter part of the year, created a shortage of succulent feed for dairy stock, and this seriously affected milk production. As a result of the adverse conditions, more dairy produce had to be imported from overseas than has been the case for many years.

Good dairy cows have been scarce and expensive, and the local supply of dairy animals has been, and still is, far below the demand, with the result that a large number of dairy animals have been imported from the Union.

The Friesland is still the most popular of the dairy breeds for this country, but there is an increasing demand for Ayrshires and Red Polls. Jerseys will no doubt receive a good deal of attention from dairy farmers when the Government herd of this breed is established. Being a small-framed and hardy animal, they require less feeding than other dairy breeds, and the quality and quantity of the milk of Jersey cattle equal those of most dairy breeds. In the Union of South Africa this breed is making rapid headway as a purely dairy animal.

The treatment and feeding of dairy stock in this Colony on the whole are improving, but in many cases still insufficient attention is paid to these very essential matters.

The average standard of milk production is still low, and to improve this it will be necessary for dairy farmers to adopt up-to-date methods for carrying on dairying. Milk recording is essential, and only by adopting this method can the farmer find out his payable and unpayable dairy animals. It costs about as much to feed and look after a poor milker as a good one, and the sooner culling is commenced in the case of the former the better for the farmer.

The dairy industry in Mashonaland has made rapid progress, and it is estimated that at least four times as much cream is now received in the Salisbury Creamery Depot as was delivered five years ago, when the Depot was established as a temporary measure. The industry is reaching the stage when a new and well-equipped factory in Salisbury will be essential.

As the result of a meeting of Creamery representatives held in Bloemfontein in October last, it was resolved to form a South African Butter Stabilisation Association, with a view to safeguarding creameries in the event of there being a surplus of butter for export to overseas markets. An invitation was extended to Rhodesian Creameries to participate in the scheme, and it is satisfactory to learn that the largest groups of Rhodesian Creameries have agreed to do so. The

scheme is stated in some respects to be similar to the Paterson scheme in Australia, and every creamery participating will pay a voluntary levy of one farthing per pound of butter manufactured, and this fund will be used as an insurance against loss in the event of surplus butter being exported overseas by any creamery participating in the scheme.

The season has been most unfavourable for cheese-making, and large quantities were imported from the Union and from overseas.

The road motor services have proved most helpful in many areas, but it is not felt that these services always receive adequate support. It will be most unfortunate if any of the existing services have to be withdrawn through lack of support, and, as pointed out by the Dairy Expert, a successful and efficient road motor service not only helps to open up a district, but must inevitably increase the value of land in the district.

Steps are being taken with a view to establishing and organising the dairy industry on co-operative lines, and it is hoped that the scheme put forward will receive the serious consideration of all farmers interested in this industry.

The pig industry continues to make satisfactory progress, but has not yet reached the stage of exporting pig products to overseas markets. More attention is being given to the housing and feeding of the animals, and there is a general all-round improvement noticeable. Prices have been good throughout the year, and there has been a steady demand for the class of pig required by bacon factories in the Colony.

Poultry Industry.—During the year the poultry industry has been receiving increasing attention, and the Department has been unable to cope with all the demands made for visits by the poultry officers. The increasing interest being taken in this industry is probably due to some extent to the hard times experienced by many farmers during the last two seasons. It generally happens that when crops are good the poultry industry is only given secondary consideration, and the result is that the industry receives a severe set-back. On the other hand, when seasons are bad many farmers look to poultry to keep things going. There are, of course, numerous poultry keepers who devote their whole time to the industry, but these people work on up-to-date methods and get the best results from the birds. It is only natural that farmers should give their main attention to the most remunerative products, but it is unfortunate that so many people are inclined to drop poultry when the growing of some particular crop becomes generally popular. The combination of cows, pigs and poultry is a safe one to work with, and in many cases is the chief means of providing the necessary monthly cheque for the farmer.

The number of eggs imported into the Colony shows an appreciable increase over last year's imports, and the value of the imported eggs is stated to be over £19,000. Last year the value of the imports was £10,000. Whilst the increasing population and the demand for eggs by the Egg Circle to complete contracts may to some extent account for the large number imported from the Union, there is no apparent reason why the amount of £19,000 should not have accrued to poultry keepers in the Colony, who should be in a position to provide supplies to meet all demands for consumption within Southern Rhodesia and also to supply all requirements for contracts outside the Colony entered into by Rhodesian firms.

The officers of the Poultry Branch do their best to encourage the increasing production of eggs, but the results of their efforts are somewhat discouraging. The Poultry Expert, however, considers that more determined efforts are now being made by many poultry keepers to work on better and more satisfactory methods, and there is every reason to hope that next year will see the imports of eggs decreasing and the local supply nearing a stage when it can meet all requirements.

Tobacco Industry.—It will be seen from the report of the Tobacco Expert that, in spite of rather unfavourable conditions, the average yield of Virginian tobacco is estimated at 525 lbs. per acre. Had there been a ready market for the crops, this average would have given farmers a satisfactory return. Unfortunately, the position of tobacco sales has been very difficult, and prices have

been much lower than those obtaining in the previous year. This matter is not one which can be readily put right, and whilst efforts have been made to assist the industry and to create increasing interest in Rhodesian-grown leaf, it will be realised that much will depend on the class of the leaf produced. There is evidently a good demand for certain grades, and tobacco growers will, therefore, have to produce the goods for which the demand exists. The curing, grading and handling of leaf in some cases leaves much to be desired, and more care and attention might with advantage be given to this side of the business.

It is anticipated that the crop for the coming season will amount to approximately a quarter of the 1927-28 crop, as growers were strongly advised to cut down their acreage by about 75 per cent., and from returns received it would appear that this has been done.

Judging by present indications it is not anticipated that the yield per acre will be as high as last year's average, and it is estimated that the production may be anything between 5,000,000 and 7,000,000 lbs.

Cotton Industry.—Although the acreage planted to cotton was the lowest since 1923, the cotton industry now shows indications of making satisfactory progress. This position is entirely due to the untiring efforts of the Cotton Specialist and his staff. The experiments which for the past few years have been carried out at the Cotton Seed Breeding Station at Gatooma are already giving results which may be of the greatest value to the cotton industry in the Colony. In this connection the Cotton Specialist, who is particularly careful in his expressions of opinions, states:—

> "The behaviour of the jassid-resistant Cambodia strain which was grown for the first time on the station at Gatooma in 1926-27 fully justified the expectations which were then entertained. This variety matured so well when all other cottons failed to open properly that the chief obstacle to successful cotton-growing appeared to be solved. Further proofs were necessary, however, before coming to any definite conclusions. These proofs fortunately were forthcoming, and the behaviour of the strain known as U 4 in particular has gone far to demonstrate that cotton may yet be successfully grown in Southern Rhodesia."

This expression of the views of the Cotton Specialist is most encouraging, and shows that the untiring labours of the staff of the Empire Cotton Growing Corporation in this Colony are likely to be rewarded.

The report of the Cotton Specialist must be considered most encouraging for the future of cotton growing in Southern Rhodesia.

Entomology.—The report of the Chief Entomologist deals fully with insect pests affecting crops and animals. One of the main activities of this branch during the year has been in connection with the combating of tsetse fly, and he reports fully on the steps taken to hold this pest in check. In Lomagundi district the position has shown some improvement, but in other districts "fly" is causing a good deal of uneasiness. In areas where motor transport is freely used there is always a likelihood of "fly" being carried to new areas, and although the danger from this may not be very serious, it must cause stock owners in such areas much anxiety. The Director of Veterinary Research has been carrying out experiments by inoculation against trypanosomiasis, and the results obtained so far are encouraging. It is hoped that further progress in this connection will be made during the coming year for dealing with the tsetse fly menace, and if it is found possible successfully to inoculate animals and make them immune against tsetse fly, valuable work will have been accomplished.

Whilst the erection of fences and the destruction of game must assist considerably in holding "fly" in check, it would hardly seem that these methods will altogether solve the question of the "fly" menace; but, on the other hand, they assist in the settlement of areas in or adjoining "fly" belts. There is little doubt that in the past "fly" in certain districts have been driven back by settlement, and therefore fencing and the destruction of game must help in the occupation and development of those parts of the Colony now infested by "fly." The question of game destruction as a means of combating "fly" is one on which there will always be controversy, and good arguments can usually be put up both for and against this method. The same remarks could no doubt

be equally well applied to the methods of fencing and inoculation. The menace, however, is so serious that no effort must be spared successfully to cope with it, and although criticisms may be made against steps being taken to combat the pest, there should be no relaxation of effort in endeavouring to find a means of satisfactorily dealing with the menace of tsetse fly.

Chemistry Branch.—The work of this branch is steadily increasing, and it has been found impossible to meet all the demands made for visits from members of the staff. The increased desire by farmers for advice from this branch of the Department shows that more attention is being given to the question of soil deficiencies. As was stated in my last report, agricultural chemistry plays a big part in the game of successful and scientific farming, and this fact is becoming more and more realised. If there is a deficiency in the soil, the Agricultural Chemist can assist the farmer in finding a remedy which may entirely alter crop returns.

It is hoped during the coming year to commence work in connection with pasture research investigations. Funds for this purpose are being provided jointly by the Government and the Empire Marketing Board. It is proposed to establish one research station on a portion of the Matopo farm and another on "Timaru" farm, in Makoni district. The results of these investigations will, it is hoped, prove of much benefit to the cattle and stock industry generally, and if the proposed research work can solve problems of malnutrition in animals in this Colony valuable work will have been carried out.

It is hoped that all farmers and stock owners will make the fullest possible use of the staff of the Chemistry Branch, who are willing and anxious at all times to render assistance and advice.

Forestry Branch.—There is a steadily increasing interest being shown by farmers throughout the Colony in afforestation, which it is hoped will continue. The yearly depletion of large areas of indigenous timber in the Colony was becoming a matter of serious consequence, and for many years practically no tree planting was carried out to replace the timber cut for mines and other purposes. It has frequently been pointed out in the past that there is every possibility of a world-wide timber shortage, but in this Colony it is only in recent years that any real effort has been made to start tree planting on what might be termed business or commercial lines. It will be some considerable time before sufficient timber can be grown to meet local demands, but now that a definite start has been made to grow suitable timber, it is hoped that steady progress will be made, and that in a few years' time the necessity for importing timber into the Colony will cease to exist.

The demand for the services of forest officers is rapidly increasing, and it is very evident that genuine efforts are being made by many farmers to take up afforestation on a fairly large scale.

Large areas of suitable trees are being planted by the Government at the Mtao Forest Reserve and at Stapleford. The latter place was only acquired by the Government about twelve months ago, but already over 600 acres have been planted with trees. At Mtao it is anticipated that during next season not less than 1,000 acres will be planted. The Government has been accused of not moving rapidly enough with their forestry policy, but it will be seen from the report of the Forest Officer that steady progress is being made and a valuable national asset is being built up on sound lines. It may not always be realised that planting an area of 1,600 acres means that over one-and-a-half million trees have to be planted. This is no light task, as, with replacements, it probably means planting out over two million trees.

In addition to the Government forest areas, a good deal of planting is being done by companies and individuals, and the annual acreage planted to timber is likely to increase appreciably year by year.

The Arboricultural Society is doing good work by drawing attention to the necessity for tree planting, and a method of competition plots has been inaugurated with the idea of fostering and creating interest in this very important subject. It is a mistake to think, as numerous people do, that any odd piece of ground is good enough for the growing of trees. Many trees are lost through neglect, bad planting and the selection of unsuitable ground. Deep

or careless planting probably accounts for more losses in trees than any other cause. Advice can always be obtained from the Forestry Branch on tree planting, and people who anticipate planting would be well advised to obtain all the information and advice possible before they risk losing capital through errors which might have been avoided.

The report of the Forest Officer gives very full details of the work of his branch during the year.

Irrigation Branch.—This branch deals with all matters affecting irrigation, water supplies, water boring, soil erosion and general engineering connected with agricultural activities. From a purely agricultural point of view the question of soil erosion is probably the most important matter dealt with by officers of the Irrigation Branch. The damage done yearly by soil erosion is almost unbelievable, and the toll taken from the soil every year by erosion must in a few years reduce valuable agricultural land to a state when the growing of crops becomes almost an uneconomic proposition. Fortunately many farmers are taking steps to prevent erosion, and the beneficial results obtained will do more to encourage others to protect their lands than endless lectures and advice. Too much stress cannot be laid on the importance of farmers tackling the question of soil erosion without delay. All possible advice will be given by the Department as to the best methods to adopt for successfully dealing with this matter, and farmers should not hesitate or delay in applying for advice should it be desired.

The water boring drills have been continuously in operation during the year. A total of 94 boreholes were sunk, of which 64 were successful. The lowest percentage of successes was in Trelawney area, where in only one borehole out of six an adequate supply of water was found. The reason for so many failures in that area is so far obscure, as the formation is similar in all respects to that in other areas where good supplies have been struck.

It is hoped to have one additional drill in commission during the coming year, making a total of fourteen drills in all.

Investigations will, it is hoped, be carried out during the year in connection with the question of water conservation in Matabeleland. This work is very necessary, particularly in the south-western part of the Colony, where cattle breeding is carried out on a fairly large scale. As water boring may not provide the necessary supplies, the conservation of water by the construction of weirs or dams is the only likely means of ensuring adequate water supplies for stock.

Botany and Mycology.—The Chief Botanist and Mycologist deals fully with plant diseases in his report, and as new diseases seem to be discovered yearly, the work of this branch is steadily increasing. Tobacco appears to have to contend with numerous diseases, all of which are likely to take a heavy toll of the crop, but perhaps Mosaic is one of the worst diseases with which growers have to contend. In America scientists and experts are more or less concentrating their energies on Mosaic in the hope of finding some method for its eradication, but so far as is known no satisfactory means for combating the disease has yet been discovered.

It is hoped by adopting control measures advocated by the Department that plant diseases will be kept in check. In cases where any unknown disease is suspected in crops, specimens of the plants infected should be sent to the Department for inspection and report.

NATIVE LABOUR.

During the year fewer complaints than usual have been received in connection with shortage of native labour. The efficiency of native labourers, however, shows little signs of improvement, and whilst the rate of pay for native farm labourers may be low, there is no doubt that inefficient labour is dear at any price.

AFRICAN COAST FEVER.

The position regarding African Coast Fever has improved tremendously during the year, particularly in Matabeleland, where intensive supervision of dipping and loyal co-operation of cattle owners have resulted in large areas being cleared of disease. If cattle owners throughout the Colony continue on the lines

adopted by farmers in Matabeleland in areas which were heavily infested with African Coast Fever a few years ago, there seems to be no reason why this disease should not be reduced to a minimum or even eliminated entirely. Unfortunately there is always the possibility of odd farmers in areas where African Coast Fever has existed neglecting to keep their cattle clean, which will probably mean a recurrence of the disease at some later date.

LOANS FOR FARM DEVELOPMENT AND PURCHASE OF STOCK.

Many applications for loans for farm development purposes and for the purchase of stock have been received, and the funds voted for these purposes have been almost entirely allocated. These loans are of the greatest assistance in helping farmers to carry on during difficult periods.

LEGISLATION.

The following Bills affecting the Department were passed during the year:—

Victoria Falls Reserve Preservation Act, 1928.—This Bill was introduced with a view to protecting the surroundings of the Victoria Falls. Owing to wilful damage in the vicinity of the Falls, the Governments of Southern and Northern Rhodesia each decided to introduce an Act and regulations for protecting an area surrounding the Falls. A Curator has been appointed, whose salary is paid jointly by the two Governments.

Land Tax Act, 1928.—This Act makes provision for the taxation of all land held under title which is unoccupied or inadequately developed. It is anticipated that the Act will come into force during 1929. The tax to be imposed is one per centum upon the unimproved value of the land as assessed by owners. The Government will have the right under the Act to expropriate any land required for settlement at its taxable value plus ten per centum, together with the agreed value of any improvements.

The Herbage Preservation Ordinance, 1915, Amendment Act, 1928.—This was a very short amending Act providing that tenants or persons in charge of land must give notice to their neighbours when they propose to burn grass. In the original Ordinance, the owners of land only had to give notice, and no provision was made for lessees or managers of farms giving notice to adjoining land owners of their intention to burn grass.

Staff.—I have again much pleasure in placing on record the good work done during the year by all members of the Department.

D. McDONALD,
Secretary,
Department of Agriculture.

LIST OF ANNEXURES.

"A"—Statistical Return, 1914 to 1927.

Reports of:—

"B"—Chief Agriculturist.
"C"—Dairy Expert.
"D"—Poultry Expert.
"E"—Tobacco and Cotton Expert.
"F"—Cotton Specialist.
"G"—Chief Entomologist.
"H"—Chief Chemist.
"I"—Forest Officer.
"J"—Irrigation Engineer.
"K"—Botanist and Mycologist.
"L"—Editor, *Rhodesia Agricultural Journal.*

	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927
Cattle—														
Number of European...	341,878	394,856	468,504	532,311	600,447	678,508	772,891	905,040	936,251	993,608	1,003,629	1,006,086	991,216	954,835
,, Native ...	406,180	445,795	491,522	551,632	610, 00	652,776	744,402	845,498	864,894	927,343	1,005,277	1,095,841	1,197,466	1,370,567
Total	748,058	840,651	960,026	1,083,943	1,210,547	1,331,284	1,517,293	1,750,538	1,801,145	1,920,951	2,008,906	2,101,927	2,188,682	2,325,402
Total acreage under cultivation as summer crops	183,407	202,946	249,038	229,953	205,439	211,094	237,268	228,000	266,607	286,837	334,604	355,481	346,776	389,824
Maize (European)—														
Acreage	167,012	174,647	203,150	192,148	173,313	173,467	186,246	181,729	220,937	231,638	232,947	239,662	267,354	295,290
Yield (bags)... ...	914,926	680,285	938,130	591,722	889,969	1,120,548	1,220,768	662,636	1,505,580	1,080,084	1,041,904	1,393,654	1,659,597	1,227,136
Tobacco—														
Acreage	1,370	1,310	1,995	3,247	4,197	7,504	9,531	10,174	9,054	8,003	8,441	13,915	30,164	47,722
Yield (lbs.)	426,423	637,261	910,684	620.171	1,467,612	2,947,627	3,746,982	3,182,359	2,810,781	3,878,460	2,405,940	5,659,809*	19,264,532	24,889,244
Butter (lbs.)—														
Farm	151,916	294,568	221,965	204,886	209,439	294,784	244,761	255,104	292,964	338,343	425,018	393,539	382,443	369,211
Creameries	...	...	...	...	...	...	...	...	282,850	554,206	871,714	1,002,850	1,168,847	1,342,348
Total	...	...	...	...	...	...	...	...	575,814	892,549	1,296,732	1,396,389	1,551,290	1,711,559
Exports—														
Maize and mealie meal (bags)	205,441	363,349	76,390	252,219	216,348	338,144	513,640	365,139	72,120	790,810	407,585	419,407	486,350	368,027
Tobacco (lbs.) ...	2,237,580	1,534,883	1,311,411	705,597	896,701	829,608	1,737,473	2,383,284	2,248,375	3,973,832	5,018,774	2,435,507*	4,287,833	15,756,802
Cattle	12	7	12,815	13,221	23,672	27,735	37,285	12,408	23,938	34,841	50,770	60,543	74,821	46,898
Butter (lbs.) ...	55,041	48,648	75,319	282,336	106,227	125,225	204,678	421,815	277,700	342,759	589,825	560,688	775,023	785,741

* In connection with the above figures, it should be noted that while cattle, butter and exports are for the calendar year ended 31st December of the year shown, the acreage under summer crops, as also the figures for maize and tobacco, are for the season in which planting was commenced in the year under which the figures are shown, but the crop was not reaped until the following year. Exports, therefore, should be taken as relating to the crop reaped during the year previous to that under which the exports appear.

Annexure "B."

Report of the Chief Agriculturist for the Year 1928.

Season and Crops.—The crop year opened favourably, and until about the end of January the rainfall throughout most districts was all that could be desired. From that date onwards, however, severe droughts of varying duration were the rule, and often the rains which did subsequently fall occurred in such light showers and at such long intervals as to be of little help to the crops. In Mashonaland, those that were planted early, and which benefited by the favourable weather conditions of the first two-and-a-half months of the growing season—middle of November to end of January—generally gave fair returns, but later sowings suffered very severely, and in many instances returned almost negligible yields.

The adverse seasonal conditions were reflected by a greatly reduced maize crop. The acreage planted by European farmers was about 290,000 acres, as compared with 267,354 acres the previous year, but the total production was only about 1,226,023 bags, as compared with 1,659,597 bags in 1927. The acre return was approximately 4.37 bags, as against 6.20 bags an acre in the previous season.

Ground nuts occupied about 6,116 acres, which was nearly 1,700 acres less than the area planted in 1927, but the average yield was 8 bags, as against 8.40 bags an acre, an indication of the ability of this crop to withstand droughty conditions.

Sunflower, on the other hand, received increased attention, the area planted being about 3,177 acres, as compared with 2,681 acres in 1927, and production reaching 12,760 bags, as against 9,514 bags the previous season. The yield in both years, however, was very low, the average being only 4.5 bags per acre.

Legumes, including beans of various kinds and cowpeas, grown for hay and green manuring, showed an increase of 800 acres, as compared with the previous year, and of this increased area, 500 acres were planted for ploughing under. Even so, however, the total acreage of green manure crops was only 3,177 acres, which is less than one per cent. of the total area under crops. Bearing in mind that green manuring, combined with the use of suitable artificial fertilisers, has proved, locally, a most effective and economical means of restoring soil fertility, the absurdly small proportion of the arable land planted each year to green manure crops is a matter of very serious moment. Maintenance of the fertility of the agricultural soils of a country is a matter of national importance. In the case of farmers working large areas of land, rotation of crop on any appreciable scale is restricted by limited outlets for the produce and by the small variety of cash crops which can be grown; available supplies of farm manure are entirely inadequate for the acreage annually under the plough. The only immediate and practical method of saving the soils of the Colony from the ruinous impoverishment now taking place lies in a wide adoption of the practice of green manuring, combined with the application of artificial fertilisers.

Farmers have admittedly had much to contend against, and sympathy is undoubtedly due to them. But the solution of many of their difficulties lies in their own hands. Taken as a whole, they have not yet got down to solid, serious farming. Many non-successes are unquestionably due to lack of system—to farming without a definite purpose—and to dropping one line of activity before it has been fully studied in order to snatch at something newer and apparently more attractive. Inconsistencies of this kind lead nowhere, and instances are numerous where, after years spent on the same farm, the owner is no nearer to a settled policy and a solid basis to his business than when he started. There are also many cases where second best methods are thought to be good enough, but in farming there is no greater fallacy than this. The only man who will succeed on the land is the one with a clearly thought out and settled policy, who knows what he wants to do, and how and why to do it, and above all who brings to every operation of the farm, be it in respect of stock or crops, a maximum standard of efficiency. To-day these conditions are far from being realised. Some farms are over-stocked. Very few farmers grow sufficient of the most suitable food crops for the requirements of their live stock. Winter ploughing

is widely neglected, poor ploughing is of common occurrence, planting is often delayed unduly late, and weeds are not adequately controlled. More extensive rotation of crops could be adopted if more attention were paid to growing food for live stock and to fattening beef cattle. These are only a few of the directions in which the farmer, aided by the Department of Agriculture, can and must help himslf if he is to make a success of his business.

District Agricultural Advisers.—At the end of September, on the expiration of the contracts of the District Tobacco Advisers, opportunity was taken to appoint in their places three District Agricultural Advisers. Young men with an agricultural college training, and with several years' practical experience of farming, were selected for these posts and were stationed as follows:—One at Umtali, to serve the eastern districts from the border to and inclusive of the Marandellas district; one at Gwelo, to serve the Midlands area between the Umniati and Shangani Rivers and as far east as Victoria district; and one with headquarters at the Matopo Farm to serve Matabeleland. These Advisers will act as liaison officers between the areas in which they are stationed and the headquarter staff of the Department of Agriculture. Their whole time is occupied in farm visits, and it is intended that they shall perform duties similar to those of the County Agents who, in England and the United States of America, have proved such a potent factor in promoting better farming methods. At the time of writing, these officers have only been in their districts for four months, but, judged by the work already accomplished, it is evident that where the farmers are willing to be helped, the services of these Advisers are being utilised in a manner which, within two or three years, should bear fruitful results.

Horticulturist.—The Horticulturist has continued to divide his attention equally between the citrus and the deciduous fruit industries, and his time is fully employed in this manner. During the year he visited 251 farms in the chief fruit growing districts. He attended the meetings of eight farmers' associations and gave nine lectures and demonstrations on various aspects of fruit culture and packing. Extension work of this kind occupied 138 days. Large horticultural exhibits of a highly educational nature were staged at the Bulawayo and Salisbury Shows. The following extracts from this officer's annual report are of special interest:—

> "An initial attempt has been made to deal with cull oranges, and with this object in view a small factory, the Rhodali Citrus By-Products Factory, has been started by Mr. Binnie of Umtali. The output of the factory during its first season has been very encouraging, 25 tons of cull fruit having been used in the manufacture of orange squash which has found a fairly good local sale. With the improved methods of manufacture and bottling contemplated, the output should be greatly increased.
>
> "It is gratifying to record a considerable increase in the amount of citrus fruit exported from Southern Rhodesia. During the year 178,000 cases of fruit were exported, this amount being 39,000 cases in excess of that of the previous season, when 139,000 cases were sent to overseas markets. The prices realised by exporters have been exceptionally high, and as much as 40s. per case has been received for Rhodesian oranges on the London market. The average gross price realised for citrus fruits during 1928 was 25s. per case, this figure being approximately 6s. higher than the average gross price for 1927.
>
> "Although included in the total export, 36,769 cases of citrus fruit were exported via Beira, this being almost double that of the previous season, when 20,500 cases were shipped from this port. In June the first trial shipment of Rhodesian fruit was exported via Durban, and the facilities and conditions at that port appear to be suitable. The railway rate is 1s. per ton cheaper and the climatic conditions more favourable than those of the Capetown route. Increased export via this port is to be expected when the new pre-cooling station is completed during 1929.
>
> "Several new commercial plantings of citrus groves have taken place recently, which, when completed, will range from 10 to 100 acres in extent. Two existing citrus exporters have recently extended their plantings.

"Fruit Tree Introductions.—Several parcels of American grown Avocado pear and Pecan nut trees have been received, but their condition on arrival has been very unsatisfactory. Those that have survived the long journey will be planted during 1929 in localities best suited to their requirements. Forty additional deciduous fruit trees were planted in July at the Tobacco Experiment Station; this brings the total planting to 100 trees. The growth and general condition of the trees are very satisfactory, and valuable information should be gained in the near future as to the most suitable varieties for sand veld areas.

"Several commercial orchards of deciduous fruit trees have been laid out and planted during the year, most of these being in the Makoni district, where this class of fruit gives great promise.

"Tea and Coffee.—The tea plantings made by Messrs. Ward and Phillips, at New Year's Gift, Chipinga, have been extended, and there appear good prospects of this crop proving suitable in parts of the eastern area of the Colony. Several additional plantings of coffee have been made during the year; these range from one acre on Mr. G. Rattray's farm, at Bindura, up to 10 acres on Mr. Taylor's farm, Manchester, near Umtali. Many enquiries have been received concerning coffee culture, and free issues of seed have been made to many of those interested in the crop."

Demonstration Farms and Stations.—A perusal of the brief particulars which are later given of the crop yields obtained on these farms and stations, during a very unfavourable season, throws into strong relief the true agricultural possibilities of this Colony. The Gwebi farm, over 412 acres, produced 11.6 bags an acre of maize on a rainfall of 24.79 inches, in spite of an unbroken drought of 32 days from the 13th February to the 15th March. This return was 0.6 bag an acre higher than for the previous year, when 26.38 inches of rain were recorded and when intervening dry spells were not nearly of such long duration. On the Matopo farm Mr. Mainwaring produced 524 bags of maize from 108 acres on a rainfall of 12.59 inches, entirely unaided by irrigation—an average of 4.85 bags an acre. On the granite sand-veld area of the Gwelo Demonstration Station, five acres under maize experiments returned an average yield of $5\frac{1}{8}$ bags of grain an acre under a rainfall of 19.61 inches, of which only 2.20 inches fell subsequent to the 20th of January. On the red soil area of the same station maize yielded $6\frac{3}{4}$ bags to the acre, and ground nuts $12\frac{1}{2}$ bags an acre. At the Bulawayo Demonstration Station, on an indifferent soil and with a 14.62 inch rainfall, of which only 1.5 inches fell after the 19th January, returns of grain were admittedly negligible, but large supplies of silage crops, coarse fodders and leguminous hays were produced.

On the Tobacco Experiment Station, Salisbury, from poor light sand, maize yields varying from 4.5 to 9.5 bags an acre were obtained after two fertilised crops of tobacco, without any additional fertiliser treatment to the maize. Under similar conditions maize and velvet beans grown together for silage yielded 8 tons of green fodder an acre, while ground nuts returned from 13.5 to 16.7 bags of unshelled nuts an acre.

No extraordinary or uneconomical methods were employed to secure these results, and if such can be obtained on the Government farms and stations, they can equally well be achieved and surpassed by the ordinary farmer when he has learnt the lessons which these institutions can teach him.

The Gwebi Farm.—The policy of conducting this farm on strictly commercial lines as a demonstration farm for Mashonaland has been adhered to. Four or five families of married settlers securing local experience before taking up land for themselves are usually in residence, but no claim is made to give these embryo farmers any special instruction other than that which they obtain by daily intercourse with the farm staff and by taking part in the ordinary operations of the farm. The staff consists of a manager, a stockman, an assistant for crops, and, lately appointed, a stores and accounts keeper.

The rainfall for the season totalled 24.79 inches, but an uninterrupted drought prevailed for 32 days, from 13th February to the 15th March.

Maize being the principal grain of the farm, 412 acres were planted to this out of a total of 680 acres under crop. Two hundred acres were hand-planted in check rows and 212 acres were sown with the maize planter. A mean yield of 11.6 bags (203 lbs.) was obtained, the hand planted maize giving about 2⅓ bags an acre more than the machine planted, the average yields being 10.4 and 12.8 bags an acre respectively. Ground nuts yielded 15 bags (75 lbs.) an acre, Kherson oats 600 lbs. grain, Kinvarra oats 423 lbs. grain, sunflower 9 bags (100 lbs.), Dolichos bean hay 2 tons, and maize and bean silage 6 tons an acre.

Owing to the late date at which the rains broke, farm-grown food supplies towards the end of the year became very scarce and were barely adequate for the needs of the stock.

Since the policy of conducting the Gwebi as a demonstration farm was inaugurated, it has been realised that this movement would be of little value unless accurate farm costings of all the operations were kept. The work of keeping detailed accounts and records was more than the farm manager could cope with, and during the year a stores and accounts keeper was appointed. All farm books and records are kept by this officer, who has studied farm costings in England, and all details are submitted weekly or monthly to the Accountant of the Department of Agriculture, by whom the figures and records are checked and compiled. The first result of this system of costing was recently given in the *Agricultural Journal*, when full particulars of costs and profits on the fattening of 62 bullocks and 2 cows were published. The average profit on these animals, charging farm-grown foods at fair market prices, and including all services and purchases, was £3 15s. 5d. per head, while in addition over 100 tons of farm manure was made in the process of fattening. The Farm Manager reports that—

> "The Friesland herd, both pedigree and grade, has continued to do extremely well. All cows are milk recorded, and particulars are published in the *Agricultural Journal*. Very few of the cows yield less than 3 gallons a day, and the average yield per cow in milk is 4 gallons.
>
> "The pedigree herd at the beginning of the year numbered 33 head, and at the end of the year 50 head. The grade herd numbered 33 females on the 1st January, 1928, and 61 at the close of the year.
>
> "The pigs—Middle Whites and Large Blacks—have proved profitable, the cross-breds being sold to the bacon factory and pure-bred Middle White boars and sows to local farmers. The most successful batch of bacon pigs were got away to the factory at 4½ months old, weighing 180-200 lbs. live weight. Considerable improvement in this direction has been effected since the new piggeries were built. Pigs on hand usually number about 50 of all ages, including 7 or 8 brood sows.
>
> "Sheep have again failed to give good results, and the flock is gradually being disposed of.
>
> "Thirteen acres of eucalyptus were planted out in January, and a fair stand of trees was obtained. Fifteen acres of bush land were cleared and stumped for tree planting this season. Development work of various kinds, to a modest extent, was also carried out in other directions. Nursery beds for the raising of 25,000 gums were prepared and sown; a commencement was made in roofing the grinding floor, and work was begun on three miles of public motor road which is to be opened through the farm."

At the end of March a very successful Farmers' Day was held, at which the attendance was most gratifying.

Certain labour-saving devices have been under trial. A tractor fitted with a producer-gas plant as motive power was tested exhaustively, as also was a maize picker. In neither case were the results such as to justify these plants being recommended. A ground nut lifter was operated successfully, and more recently the Oliver cultivator, a mole draining plough and a broadcast fertiliser distributor have been and still are under trial.

During the current season 739 acres will be under crop, and this area has been worked with seven and a half spans of oxen. The average rate of native

wages for the year is 17s. 6d. per mensem—not, of course, including food. Seven drivers are employed at an average monthly wage of £1 7s. 6d. The average number of native labourers employed is ninety-five.

The Matopo Farm.—Mr. Mainwaring, Agriculturist, was seconded as Manager of the farm towards the close of 1927, and has been in charge there during the year. The season was most unfavourable for crop growth, the rainfall, as shown below, being considerably below normal:—

Rainfall in Inches.

October	1.62
November	2.49
December	2.99
January	4.58
February	1.71
March	0.19
April	0.01
Total	12.59

The staff of the farm consists of two white assistants in addition to the manager, native labourers varying in number from 70 to 80 a month. Owing to two successive dry seasons the water in the dam fell to a very low level, and on this account only a small acreage of winter cereals was grown. Much good land below the canal has been rendered useless by abandoned and washed-out irrigation furrows. New furrows have had to be dug, and the old ones are being filled in as circumstances permit. Much of the labour has been employed on development work of a permanent character. The supply of voluntary native labour has been fairly constant. Strict economy has been observed in the labour bill, which has been considerably reduced as compared with the previous year. The manager reports that the following permanent improvements have been effected with native farm labour during the year:—

(1) Piggeries, including feed room.
(2) Dairy.
(3) Bull boxes and calf houses.
(4) Implement shed.
(5) Piggery paddocks.
(6) Native compound (40 huts).
(7) Additions and improvements to dipping tank.
(8) 90,000 bricks of good quality were made.
(9) A well was sunk in sheep paddocks and water obtained at 30 feet.
(10) A new ground silo excavated.

His report continues:—

> "With the exception of a small section adjoining the Matopo Estate, the boundary fence of the farm has been completed, all arable land has been fenced, and a large portion of the grazing land has been divided into paddocks. The main road through the farm to the Terminus has been made (a distance of three miles) at a comparatively small cost, and is greatly appreciated by visitors who wish to make a circular tour to the 'World's View.' Including other farm roads, between four and five miles of road-making has been completed. The farm was entirely devoid of exotic trees of any description, and in order to provide wind-breaks and to beautify the surroundings a beginning has been made in raising seedlings and planting trees. About 10,000 of different kinds were planted, including several *Eucalyptus* varieties, *Pinus insignis*, *Pinus longifolia*, *Pinus halepensis*, *Cupressus arizonica*, *Cupressus lusitanica* and *Callitris calcarata*. Considering the very dry season, these trees have done extremely well; about 70 per cent. are established and have made very rapid growth. Of the *Eucalyptus* varieties, *E. rostrata* (red gum) has made the strongest growth. The performance of these improvements and the erection of buildings, of fencing and the cultivation and clearing of land which had been left idle for a number of years, in an efficient manner, have demanded much attention, but they have been

works of necessity, and will still further require to be carried towards completion before experimental work on an extensive scale can reliably and conveniently be carried out. As far as circumstances would permit, a number of experiments were conducted in growing various crops, and in most cases different varieties of each, in order to get some knowledge regarding their suitability to local conditions. Definite and reliable information regarding sound practices of field husbandry in Matabeleland is practically unobtainable.

"Crops.—108 acres were planted to maize for grain and 524 bags reaped, the yield being 4.85 bags (203 lbs.) per acre. Varieties grown were Hickory King, Krug (an early yellow dent hybrid), Potchefstroom Pearl and Salisbury White. One hundred bags of seed maize were sold to farmers and distributed through the Matabeleland Farmers' Co-op. Society. Fifty acres of maize were cut for silage. Sixteen acres of dolichos beans gave a very fine crop, and were harvested for hay and grain. Eight acres of ground nuts were planted, but, owing to drought and lateness of planting, proved a failure. Pumpkins yielded 12 tons. Of cattle melons, 60 tons were harvested, and 70 tons of veld hay were mown and stacked in good condition. About 24 acres were broadcasted to winter cereals under irrigation—oats and barley—which returned fair yields. Fifty-five varieties and selections of wheat, oats, barley and rye grown experimentally and under irrigation proved interesting and instructive, and the following varieties gave the most promising yields: Wheats—Kenya Governor, Droop No. 3, Union 17, Wit Klein Koren and Booren. Oats—Kinvarra C. 45 (a selection from the Salisbury Experiment Station). Barleys—Cape six-rowed was outstanding.

"Live Stock.—Trek oxen maintained themselves in fair working condition on the natural pasture during the dry season without extra feeding. They were constantly in hard work, and this satisfactory result must be attributed to allowing them to graze in paddocks instead of being kraaled at night. Forty bullocks were fattened during the winter, twenty-one of which were sent overseas and the remainder railed to Johannesburg market, where they realised profitable prices. Eighty-seven store bullocks, principally Lincoln Red grades, were purchased for fattening next winter, but unfortunately three of these died during the month of October. The remainder of the stock on the farm, with the exception of pigs, which consist of Large Blacks and Large Whites—eminently suitable for bacon production—are as yet of a nondescript character.

"A successful Farmers' Day was held on 14th March, 120 people attending; after an inspection of the farm and crops under severe drought conditions, these visitors must have realised that the farm is doing sound work which will benefit the agriculture of the Colony in the near future.

"Specimens of various plants and seeds were sent for exhibition to the Bulawayo and Salisbury Agricultural Shows. Much practical interest was shown in these exhibitions, and much valuable information, tending to raise the standard of farming, was thereby disseminated. Our thanks are due to these societies for their assistance and co-operation in connection with these exhibitions.

"The work in the office is increasing; many enquiries are received from farmers as to the kind of crops they should plant, the time of planting and so forth. The information asked for has been gladly afforded. A keen interest has been evinced in the farm, by farmers in particular, and by the public in general. Visitors have numbered about 400, many of these coming from Northern Rhodesia and different parts of South Africa."

Salisbury Experiment Station.—The field investigations at this station are confined to all crops found suitable to Rhodesian conditions, except tobacco. A few plots of fire-cured types of tobacco appear in the rotation experiments, but these are grown in the course of soil studies rather than as actual experiments with tobacco, and the leaf is transferred to the Tobacco Experiment Station for curing. In general, the work has followed the lines of previous years, and full details thereof will shortly be published through the medium of the annual

report of the station, which is printed yearly in the *Rhodesia Agricultural Journal*. The activities of an experiment station of this kind must frequently be enlarged, for as investigations progress new aspects of many of the problems are revealed, which in turn must be enquired into if the results of the major experiments are to yield conclusive information.

In the course of his report the Station Manager writes:—

"Trials with promising strains of oats and sunflowers, with a view to obtaining varieties which possess disease resistant characters combined with the ability to produce heavy crops of high quality, have been continued. As a result of these trials, two varieties of Kherson oats and one of black sunflower have been sent to the Gwebi farm for trial on a commercial scale. The number of strains of these crops which have been isolated and tested over a period of four years is approximately as follows:—

Kherson oats	200
Kinvarra oats	250
S.E.S. oats	55
White sunflower	75
Black sunflower	40

"Trials with wheat as a summer crop have been continued, and the variety named Kenya Governor—introduced through the courtesy of the Department of Agriculture of Kenya Colony—is, so far, the most promising. Yields as high as five bags per acre of this wheat have been obtained on small plots, and serve to indicate the success which may be achieved in the breeding of rust resistant types of wheat by the recently appointed Plant Breeder. Experiments commenced this year are designed to investigate the following problems:—

(1) The effect of applying fertiliser to a green manure crop which is to be followed by maize, compared with the effect of applying the same fertiliser direct to the maize crop, following an unfertilised green manure crop.

(2) The relative effect of different methods of application of fertiliser to the maize crop, e.g., drilled in the furrow, broadcasted and ploughed under, broadcasted and harrowed in.

(3) Relative merits of various crops when used for green manure—

(a) as pure stands of either leguminous or non-leguminous crops;
(b) mixed leguminous crops;
(c) mixed leguminous and non-leguminous crops.

(4) Further sowings of a number of species of grasses which experiment has indicated as being of special value for the improvement of pastures. Concurrently with these trials, enquiries into the influence of applications of fertilisers to the more promising grasses have been extended with a view to studying the effect on winter and spring growth and on the setting of fertile seed.

(5) The number plots devoted to an enquiry into the effect of applications of lime to the soil and to various crops have been increased.

"The desire on the part of farmers to provide foodstuffs for use during periods of drought is indicated by the increased interest which is being taken in succulent crops. Over 100 farmers have been supplied with small amounts of edible canna for trial purposes, and free issues of sweet potatoes and spineless cactus have much exceeded those of any previous season.

"Comprehensive exhibits illustrating the scope of the work of the station were sent to all the Agricultural Shows, excepting that at Bulawayo, the Government exhibit for which was drawn from the Matopo Farm and the Bulawayo Municipal Demonstration Station. A supply of seeds and sheaves of crops and grasses was also sent to the High Commissioner's office in London for publicity purposes.

"Eighty-four introductions of new crops or new varieties were made during the year, and free issues of seed and plants were as follows:—

To farmers in Rhodesia	589
To other Government institutions in Rhodesia ...	105
To foreign institutions and experiment stations ...	151."

Visitors to the station during the year numbered 180. The station is becoming increasingly a field laboratory for the Agriculturists and other officers of the Department, and as the investigations become more intricate, many lose their immediate practical interest to the farmer. For this reason probably many farmers now visit the Gwebi farm in preference to the Salisbury Agricultural Experiment Station.

Tobacco Experiment Station.—The season on this station was none too favourable, the total rainfall amounting to only 22.22 inches, of which only 5.84 fell between the beginning of February and the end of April. All crops suffered from drought, especially maize. One hundred and fifty-four experimental plots were planted, the majority being half an acre in area. The principal field investigations in progress were:—

(1) Commercial fertiliser trials with tobacco.
(2) Distance planting trials with tobacco.
(3) Variety trials with tobacco.
(4) Various green manure crops in relation to subsequent crops of tobacco.
(5) Fire curing and air curing types of tobacco.
(6) Rotation experiments in which tobacco is the main crop.
(7) Yields obtainable from various crops following two consecutive crops of tobacco treated with fertiliser.

In addition, the following special investigations were carried out by the officers indicated:—

Irrigation Engineer.—Heat radiation tests in flue barns.
Mycologist.—Dusting experiments as a prevention against white mould in tobacco.
Chief Chemist.—Analysis of various cured and uncured types of tobacco leaf.

In all, 78 acres were under crop, of which 40 acres were planted to tobacco.

The tobacco crop suffered a severe attack of angular spot early in the season, but this was checked by vigorous priming, and very little spotted leaf was visible at curing time. The final yield of cured leaf, including scrap, was 24,088 lbs., or an average of 602.2 lbs. per acre. The percentage of scrap is invariably high owing to the greater handling the crop is subjected to when weighing to ascertain plot yields. The average return per acre was reduced by reason of some of the later planted plots failing to ripen and being left unreaped.

In the course of his report on the year's work the Manager of the station states:—

"In addition to special exhibits prepared for the Agricultural Show, 290 lbs. weight of samples comprising various grades, varieties and types of tobacco leaf were packed for despatch to the High Commissioner's office and the Continent. A comprehensive exhibit of tobaccos and various crops grown on the station was staged at the Salisbury Show.

"A new field, twelve acres in extent, was stumped and cleared. Eight acres of vlei land was prepared and put under winter crop experiments. Two new furnaces, namely, the 'Carolina' and the 'Rhodesian,' were built into Nos. 5 and 6 barns respectively.

"Forty additional fruit trees were planted in the orchard, bringing the total number of trees to one hundred. The orchard is an experimental one, new varieties of plums, peaches, apples, apricots, etc., being tried out under the direction and supervision of the Government Horticulturist. Demonstrations and practical instruction in orchard work are given to the apprentices by means of this orchard.

"The small herd of Friesland cattle continues to supply milk to the white staff and apprentices, and at the same time gives valuable service in training the students in the proper methods of managing, handling and feeding dairy stock.

"Apprentices.—Towards the end of the year the second batch of apprentices completed their two years' course of instruction and passed out. These youths were presented with the Tobacco Experiment Station Certificate, and, in spite of the fact that the tobacco slump was at its height, they were, in nearly every case, able to obtain employment on the land. The total number of apprentices now receiving instruction is thirteen. One apprentice was found unsuitable, and was withdrawn by his parents. Apprentices continue to help in all the manual work in progress on the farm, and receive a good grounding in general farming as well as in tobacco culture and curing."

In addition to the practical instruction given, the apprentices received 23 lectures from various officers of the Department of Agriculture. The practice of each apprentice or a pair of apprentices working a small field of tobacco entirely unaided by native labour has been continued, and undoubtedly provides a most valuable means of imparting instruction in practical work. During the coming year the system will be extended so that each pair of apprentices will be solely responsible for a small field worked under a rotation which will include three other crops in addition to tobacco.

Examinations set by the Manager, in conjunction with the various technical officers concerned, were held at the end of the instructional term. Recommendations based on the results of these examinations, coupled with the practical work done, are then available to prospective employers.

Bulawayo and Gwelo Demonstration Stations.—Both these stations experienced most unfavourable seasons. Prospects were excellent up to the end of January, but from that date on the acute drought conditions proved most detrimental to plant development. On the Bulawayo station the total precipitation was 14.62 inches, of which only about 1.5 inches fell subsequent to the 19th January. At Gwelo 19.61 inches of rain fell between October and the 20th of January, after which only 2.20 inches were recorded during February, March and April. For the first time on record since its inception the maize yields on the Matabeleland station were insignificant, and most of the plots were not worth reaping for grain. However, the Town Ranger, Mr. Babb, who is in charge of the work, says, "Out of forty acres of maize planted, I had enough baled stover to carry 42 head of oxen through the ploughing season and engaged on other commonage work during the winter, without any other feed except veld grazing."

Apart from maize, other crops grown for fodder and hay gave fair yields. Sudan grass, on 10 inches of rain, returned 15,000 lbs. of green fodder per acre, and kaffir corn gave 16,770 lbs. of green fodder an acre with a rainfall during its growing period of only 12 inches. Dolichos beans yielded up to 13,500 lbs. of green fodder an acre, velvet beans 7,500 lbs. and kaffir beans 5,961 lbs. an acre. The above results are a clear indication that even in what was probably the worst farming season that Matabeleland has experienced for very many years, farmers in that part of the Colony can yet produce ample supplies of fodder for stock food, if they put their backs into the business.

Results on the Gwelo stations were even more striking in view of the rainfall records referred to above. The Sanitary Inspector in charge of these stations records that the sand area in particular suffered from the drought, and that reaping of the plots might have commenced at the beginning of March, and actually did begin at the end of that month. In spite of this, the average return from 5 acres planted to maize was 5 bags 27 lbs. per acre. The maximum plot yield—half an acre—following beans ploughed under was 7 bags an acre. Two acres of ground nuts yielded an average of $8\frac{1}{3}$ bags an acre. The red soil area did not suffer so badly as the sand veld area, and here the average maize yield from 4 acres of land under maize experiments—including a quarter acre receiving no treatment which returned under 2 bags an acre—was $6\frac{3}{4}$ bags to the acre.

Ground nuts on this class of land yielded from one acre 12½ bags of unshelled nuts. Legumes on both stations also did well, and gave excellent returns of fodder. These two stations have, for several years, afforded to farmers of the Midlands an admirable object lesson of the results which can be achieved by adapting modern farming methods to local conditions.

Maize Grading and Export.—Maize grading for export commenced on the 4th July, and continued steadily until the end of the year. Two permanent and one temporary grader were employed. Fewer difficulties than usual were encountered in the grading, and the relations between the farmers and the graders and the railway officials, by whom the latter's movements are directed, were particularly cordial. The warnings issued to farmers to avoid riding wet maize to the railways have undoubtedly been effective, and many owners submitted their maize for moisture test before commencing to ride. One hundred and forty-three moisture tests, in duplicate, with the Brown-Duvel tester were made. Just about half the total crop of the country was graded, namely, 674,997 bags of maize and 29,766 bags of meal. It is of interest to note that 10,000 more bags of meal were graded in Bulawayo than during the previous year. Of the total amount of maize graded, 627,200 bags were passed as 2nd grade, 14,412 as 3rd grade and 1,131 bags as No. VIII. grade. Twenty thousand bags were rejected for export, as against 14,164 bags the previous year. No maize was classified as No. 1 grade, exporters preferring to have super-grain of this quality included with their No. 2's.

The Maize Grading and Export Conference was held on the 14th March, at which many matters of mutual interest to growers, exporters and the Department of Agriculture were discussed.

The Government of the Mozambique Territory, during the period under review, gave notice of certain changes which they had made, and others which they proposed to make, in regard to the grading of Rhodesian maize at the port of Beira. Protests were made against the proposal to include slightly weevily Rhodesian maize under the general category of "weevily," as is done in the case of territory-grown maize, and this innovation in the existing regulations was finally withdrawn. Other of the proposed alterations in the agreement which governs the export of this Colony's grain through Beira would adversely affect the marketing of our maize in Europe, and negotiations are proceeding between the respective Governments.

Itinerant Extension Work.—Owing to a reduced staff, and to special duties to which it was necessary to detail Agriculturists, it was not possible to make as many farm visits as usual. In spite of this, however, 10 per cent. of the farmers of the Colony were visited on their own farms. Several visits were made to Belvoir Spinney, Charter district, on which, with the kind permission and co-operation of Mr. P. O. Brocklehurst, a commencement has been made in opening a small sand veld demonstration station for the benefit of the farmers in the Enkeldoorn area.

As usual, educational exhibits were made at all Agricultural Shows, and each Show was attended by one or more officers of the Division.

Witch Weed (*Striga lutea*).—During the year Mazoe farmers became actively alive to the presence of this parasite plant in their maize lands. Its presence in this and other districts has been known for years, and warnings against it have been given. The extremely dry season caused it to effect more than usual damage to many crops in the Mazoe Valley, and the Department was asked by the Glendale and Concession Farmers' Associations to carry out experiments with a view to its control; these were planned and are now in progress on private farms in those areas. The Government Mycologist is also prosecuting some enquiries into the matter, and touch is being kept with the investigations into the subject being carried on by the Department of Agriculture of the Union of South Africa.

General.—It is of interest to record that a number of farmers have applied to the Division for rotational cropping systems for their entire arable lands. The drawing up of these to meet each farmer's particular needs and conditions has taken considerable labour, but the time will have been well spent if the pro-

posals are adopted and faithfully put into effect. In this connection the District Agricultural Advisers are giving useful service, and are urging the adoption of definite systems of cropping on as many farms as possible in their areas.

Much of the time of all members of the staff has been occupied in farm inspections in connection with the granting of short period loans to farmers from the several funds provided by Government for this purpose. The Chief Agriculturist sits on three Loan Fund Committees, in connection with which, during the year, he has attended some thirty meetings. So far as farm tours are concerned, special attention has been given to new settlers and to sand veld areas.

Staff.—All members of the staff have carried out their duties with efficiency and enthusiasm, and special credit is due to the farm and experiment station managers, and to the municipal officers in charge of the Bulawayo and Gwelo stations, for the good results obtained in a very unfavourable season.

Publications.—The following contributions have been made:—

By the Chief Agriculturist—

Hay-making in Rhodesia.
Suction or Producer-Gas Driven Tractors.

By Mr. Mainwaring, Agriculturist—

A Farmers' Calendar of Crop Sowings.

By Mr. Marshall, Horticulturist—

Citrus Fruit Growing in Rhodesia.

By Mr. McLoughlin, Assistant Agriculturist—

Bulawayo Demonstration Experiment Station. Annual Report, 1926-27.
Gwelo Demonstration Station. Summary Report, 1923-27.
The Edible Canna.
Suggested Cropping Programmes for Farms on the Sand Veld.

By Mr. Timson, Acting Assistant Agriculturist—

The Sunflower. (Revised.)
The Castor Oil Plant. (Revised.)
Notes on Farm Practices: Gwebi Farm.
Annual Report, Gwelo Demonstration Station.

H. G. MUNDY,
Chief Agriculturist.

Annexure "C."

Report of the Dairy Expert for the Year 1928.

Dairying Season, 1928.—The year opened with good rains in January, but the promise of a good season from a dairying standpoint was spoiled by a severe drought in the latter half of January and the whole of February. The grass came into seed very quickly, and growth was checked to such an extent that, until belated rains came to afford relief at the back end of November, grazing remained sparse and water supplies in many places were markedly deficient.

The drought at the beginning of the year caused a great lack of succulent winter feed such as ensilage, pumpkins, majordas, etc., and during the long dry season from March to November dairying operations were carried on with the greatest difficulty and with very unsatisfactory results.

Milk and cream became extremely scarce throughout the Colony, and the position, especially in Matabeleland, became acute. It is feared that this bad season may have the further effect of causing a bad calving season in 1929, and the shortage of supplies, especially in Matabeleland, is likely to continue throughout the present season.

Similar conditions prevailed throughout South Africa, and in 1928 it became necessary to import more dairy produce from overseas than has been the case for many years. This set-back is to be the more regretted because the dairy industry was showing promise of becoming one of our great national assets capable of almost indefinite expansion.

Dairy Stock.—The demand for good dairy stock noted last season continues to grow. Dairy cows of a good standard quality are both scarce and expensive. Those farmers who have been in a position to meet this demand have had no difficulty in obtaining remunerative prices for their stock, but the local supply is so limited that large importations have taken place from the Union of South Africa. Locally-bred stock are, however, rightly preferred, and the demand for a good class of animal opens up a field of enterprise which our farmers should take advantage of and develop to the utmost extent.

The Friesland is easily the most popular of our dairy breeds, but Ayrshires and Red Polls seem more suitable for the lighter soils, and the demand for animals of these breeds is far in excess of the supply. In this connection it is interesting to note that the Stock Adviser, who is at present overseas, is buying on behalf of the Government and private owners pure-bred animals of these latter breeds, and there can be no question that these importations must have a profound effect on the standard of our locally-bred Ayrshires and Red Polls for many years to come. The better treatment of our dairy stock continues to receive the attention of this Division.

Full details as to treatment and feeding of dairy stock can always be obtained on application, and it is encouraging to note that greater attention is being paid to winter feeding and the hand-rearing of dairy calves.

Example is, however, better than precept, and more frequent visits of dairy farmers to the Government farms at Gwebi and Matopos would do much to convince them that Rhodesian crops fed to Rhodesian cattle will maintain dairy herds throughout the winter in as good a physical condition in this Colony as in any other country in the world.

At the same time they will learn that the farmyard manure, accruing from the practice of feeding dairy stock throughout the winter, has a profound effect in maintaining and even increasing the fertility of the soil. On many of our best arable farms the law of diminishing return has already come into operation, and a fuller and personal knowledge of what is being accomplished on our Government farms must have the effect of driving the lesson home to our farmers that the safest and surest way of combating this inexorable law of nature is to feed their stock (both dairy and beef) throughout the dry season, and to return to their lands all the farmyard manure which can be produced.

Milk Records.—The average standard of milk production in this Colony is still abnormally low, but the milk recording scheme has shown that neither altitude nor climate, as generally supposed, has any lasting effect on milk production. As good milk records can be produced at Gwebi and on private farms in Southern Rhodesia as anywhere in South Africa, although of course the number of our high producing cows is very small, both in the aggregate and when compared with the large number of scrub cattle in the Colony.

Those farmers who keep milk records regularly find that the extra trouble is almost negligible as compared with the interest aroused and the substantial benefits to be derived from milk-recording. Bulls from a milk-recorded herd are always at a premium, and the time is rapidly approaching when a bull from a non-recorded herd will have practically no value in the eyes of a dairy farmer.

The voluntary milk-recording scheme continues, therefore, to receive support, and in face of a very disappointing season those farmers who have continued sending in their records regularly are to be congratulated on their initiative and foresight.

Much more, however, remains to be done before our low average standard of production can be raised to the standard achieved by our competitors in the world's markets, but steady progress to this end is being made.

Creameries.—A new creamery fully equipped with cold storage, etc., has been established in Umtali, and promises to be most successful.

A new area for cream production has been tapped by the introduction of the Railway road motor service to Chipinga, and large quantities of cream are now being delivered into Umtali both by Railway lorry from Chipinga and by private lorries from Melsetter.

The proprietors of the "Emco" creamery, Umtali, are to be congratulated on their enterprise in catering for a long-felt want in this area, and they deserve every encouragement and support.

In Bulawayo the Rhodesian Export & Cold Storage Co., Ltd., have equipped a creamery with an up-to-date plant, but, owing to the prevailing drought in Matabeleland, this creamery has not yet commenced active operations.

The older established creameries in Bulawayo and Gwelo have had only a very moderate season owing to adverse climatic conditions, but, notwithstanding the drought, the Farmers' Co-op. Creamery Depot, Salisbury, has received more cream in 1928 than in any previous year. This depot is so limited in size and equipment that creamery operations are carried on with the greatest difficulty during the flush season. The much-needed extensions and alterations suggested last year have not materialised, and the need for a new fully-equipped creamery in Salisbury is most urgent.

Comparisons are odious, but it certainly seems extraordinary that there are no less than five registered creameries in Bulawayo and only one in Salisbury, where in 1928 practically one-third of the cream production of the Colony was received.

The dairy industry has made such rapid strides in Mashonaland that it is estimated that at least four times as much cream is received in Salisbury as was the case five years ago, when the creamery depot was established as a temporary measure. Practically nothing has been done in the meantime to cope with the increase, except the installation of an extra churn, and the congestion is now acute. No good purpose can be served by farmers increasing their output of first-grade cream if the equipment for turning this cream into first-grade butter fit for export is lacking.

It is devoutly to be hoped, therefore, that something can be done to alleviate the position during 1929. A new factory is urgently needed, and ways and means should at once be devised to equip Salisbury with a creamery which is worthy of the capital.

Creamery Butter Production.—It was to be expected, on account of the adverse season, that the total amount of creamery butter manufactured in the Colony during 1928 would show a decrease on the figures of 1927. The chief

decrease was naturally found in Matabeleland, but this decrease was partially counterbalanced by increased production in Mashonaland. It is therefore gratifying to report that for the fourth season in succession the total quantity of creamery butter manufactured in the Colony has exceeded one million pounds in weight.

South African Butter Stabilisation Association.—During the course of last season a movement was begun in the Union of South Africa, under Government auspices, to consider some means of safeguarding the finances of the creameries in the event of there being a surplus of butter for export to the overseas market. It was pointed out that unless something was done in this matter, some creameries which might be forced to export might suffer considerable financial losses.

As a result of a general meeting of creamery representatives held in Bloemfontein in October, it was resolved to form a South African Butter Stabilisation Association, of which every creamery in the Union of South Africa, South-West Protectorate and Bechuanaland decided to become members. An invitation was extended to Rhodesian creameries to participate, and it is gratifying to report that the largest groups of Rhodesian creameries have agreed to do so.

The scheme propounded by the Butter Stabilisation Association is similar in many respects to the Paterson scheme in Australia. Every creamery participating will pay a voluntary levy of one farthing on every pound of butter manufactured, and this fund will be used to ensure against loss in the event of surplus butter being exported by any creamery to the overseas market. The scheme is certainly worth a trial, and eventually its operations must have the effect of affording some measure of protection to our local creameries against financial loss.

Cheese-Making.—An effort was made during the cheese-making season to encourage farmers to produce more cheese throughout the dry season, and in one or two cases cheese-making was continued throughout the year. The season, however, was most unpropitious, and cheese-making throughout the dry season was attended with considerable difficulty. The price, however, remained high, and cheese-makers who continued throughout the year must have the satisfaction of knowing that their efforts have been the means of augmenting local supplies at a time when cheese was being imported in large quantities from overseas and from Union sources.

Mashonaland farmers continue to make the great bulk of our locally manufactured cheese. A cheese factory was, however, established last season in Matabeleland by the Bonnie Vale Cheese Factory, C.P., but on account of drought and other difficulties it had a very short career, and has since been closed down. Another firm, however, is contemplating opening up a factory in an adjoining district, and it is proposed to open a proprietary factory in Marula. These enterprises should encourage further developments in cheese-making in Matabeleland, as the climate seems to be suitable for the manufacture of a high-grade product such as is produced in the adjoining Tati Concession.

Cheese-making can be begun with a very moderate expenditure of capital, and dairy farmers in Matabeleland should endeavour in a greater degree to cater for the local market, and at the same time dispose of their dairy produce at remunerative rates. Full information as to cheese-making methods is always available, and no trouble on the part of this Division will be spared to make this enterprise a success.

Road Motor Services.—These services, inaugurated last year by the Railway administration and by private persons, continue to open up the country and to afford an outlet for the sale of perishable goods such as cream, cheese, milk, etc.

In certain areas these services do not always receive the support they deserve, and farmers have only themselves to thank if the service in these particular areas is withdrawn. A more rapid development of mixed farming operations in these areas will cause greater production of commodities for which the road motor services are designed to cater, and in this way a greater measure of support will be afforded. Farmers should realise that a successful motor service not only opens up their district, but must inevitably cause land to rise

in value. When once the value of these services is realised, it would be a calamity to any district if the service was withdrawn because of apathy on the part of the farmers and failure on their part to "deliver the goods."

Dairy Organisation.—The organisation of the dairy industry on co-operative lines has been under discussion for several years past. During the year under review a tour of the Colony was undertaken by Mr. H. Martyn-Green, and the facts of the case were clearly placed before the dairy farmers. A concrete scheme to acquire existing concerns was formulated. This scheme is now being considered by the farmers, and it is hoped that, as an outcome of this, the local creameries may be acquired and placed on sound co-operative lines.

Town Milk Supplies.—Some considerable difficulty was experienced in maintaining a fresh milk supply in all our larger centres, especially in October and November, but the inauguration of extended motor services partially solved the problem. Supplies were fairly well maintained, but the quality of the milk suffered because of the absence of succulent food. In some cases the milk was quite abnormal in composition and the butter-fat percentage was low. At the same time, largely because of the lack of milk-cooling appliances on the farms, milk quickly became sour, and in consequence the purveyors of fresh milk had a very anxious time.

Such abnormal drought as obtained in 1928 must make dairy farmers realise the value of conserving larger reserves of winter feed, especially in the form of silage. Silage need not necessarily be consumed in the same season as it is made, but if properly made will remain in good condition for years, and an extra pit or two will always be an insurance against such heavy losses from "poverty" as occurred in the year under review.

The Pig Industry.—The pig industry continues to make steady progress, and greater attention is being paid to housing and feeding. It is realised by most farmers that pig breeding in conjunction with dairying is a profitable side-line, and that a good supply of separated milk or whey is essential if early maturity is to be achieved. Without the aid of dairy bye-products, however, the growth of the pig is slow, and it is doubtful whether pig-raising under such conditions is so profitable as to warrant the building of expensive piggeries.

Some results of pig-raising at Gwebi deserve comment. When separated milk is plentiful, no difficulty is experienced in growing pigs to bacon weight (180 to 190 lbs.) in 4½ to 5 months. Such quick returns on capital are certainly remunerative, but when pigs are kept, as frequently happens, until they are 10 to 12 months old before reaching bacon weight, the financial return must be disappointing in the extreme.

The rapid development in dairying in Mashonaland will inevitably lead to a greater pig production, and it is gratifying to report that the bacon factories in Salisbury are capable of handling a much larger number of pigs than are received at the present time.

In Matabeleland, pig producers find a ready outlet for their pigs in the Union bacon factories, and it is interesting to note that the export of live pigs to the Congo is on the increase.

The time must come, however, when it will be necessary to export pig products to other markets, and in this event a greater degree of uniformity in breed of pig and weight of carcase must be aimed at.

Some experimental work will be necessary to ascertain what constitutes the right breed, the right feed and the right weight, and it is gratifying to report that pig-raising is being made an integral and important branch at each of the Government farms.

T. HAMILTON,
Dairy Expert.

Annexure "D."

Report of the Poultry Expert for the Year 1928.

General.—It is very gratifying to report that there has been a great advancement in the poultry industry during the year. The contrary was the case, as mentioned, in my report for 1927, the reasons for which were given.

The advance this year is probably due to large numbers of farmers resorting to poultry as a means of recouping themselves to some extent for losses experienced in the growing of crops last year, and to endeavour to obtain some ready cash monthly with as small an outlay as possible. Poultry farming has to a considerable extent enabled them to do so.

The older hands with their experience, and with the benefit of the advice and practical demonstrations given them in previous years, have had a very successful year, and their sales of hatching eggs, day-old chicks and breeding stock have been exceptionally satisfactory. New settlers have also benefited by this advancement, chiefly by sales of eggs and in some cases by the sale of breeding stock. Those who have been consistent and put in good work during 1928 should do well in 1929. Unfortunately, some people were too ambitious, and, against repeated advice, started in too big a way, purchasing anything from 500 to 2,000 day-old chicks, and in some cases without knowledge of the rudiments of poultry keeping. Many settlers, and also older residents in the country, have failed to realise the constant work, common sense, consistency and patience necessary for success. Others again were too confident in themselves and their previous knowledge of poultry in other countries to seek advice. Others sought advice or accepted voluntary advice from those who had either little knowledge or no practical experience of successful poultry keeping.

Notwithstanding this, there has been, as mentioned above, a satisfactory advance in the industry. The natural corollary of this is that the staff of the Poultry Division has been working at full pressure the year through, and even so, it has been impossible to carry out much work that should have been done. Personal interviews with poultry keepers seeking advice at the office of this branch have totalled 1,485, and 2,115 letters (chiefly technical) have been written by the Poultry Experts. Thirteen articles and bulletins have also been written and circulated.

Eggs.—These are still being imported. The majority are exported by the Rhodesian Egg Circle to the Congo, a rapidly increasing market. Eggs are also being imported for consumption in Rhodesia, notwithstanding the greatly increased production. The imports and exports for 1926 and 1927 and ten months of 1928 are as follows:—

Imports.

1926.		1927.		Ten months of 1928.	
Dozen.	Value.	Dozen.	Value.	Dozen.	Value.
47,080 ...	£3,653	130,455 ...	£11,592	226,594 ...	£19,254

Exports.

75,199 ...	£8,100	146,459 ...	£16,429	166,193 ...	£19,075

It has been suggested that with the great increase in the number of poultry keepers a glut in eggs will result, but, as will be noted, it will be necessary to produce many more eggs in the Colony before that stage is reached, and at present the needs for local consumption in the country alone are not being met. Further, it must be remembered that a large number of the hatching eggs purchased during the year did not hatch, and probably a still larger proportion of day-old chicks sold did not survive, owing to lack of knowledge, care and consistent attention on the part of the purchasers. Therefore the increase in egg production has to contend with many difficulties, and a glut in eggs is not very likely to arise in the near future. In the meantime the consumption of eggs is increasing more rapidly than the production. A more uniform production

can be obtained if poultry keepers would follow the advice and instruction given by officers of the Poultry Branch.

There is no doubt that Rhodesia can absorb all the eggs produced for some time to come, but it should be possible in time for our poultry farmers to supply sufficient eggs to take the place of those now being imported into the Colony.

Sales of Breeding Stock, Hatching Eggs and Day-old Chicks.—These have been phenomenal, and the older breeders, viz., those who have worked up their poultry farms on right lines with business acumen, energy, patience and especially with consistency, and who have not neglected them, have during the year reaped a good harvest, and many orders have had to be refused.

Those breeders who have entered their birds in the Southern Rhodesia Poultry Recording and Pedigree Register, which is now in full working order (close on 3,000 birds having been entered), will greatly benefit by being able to give official pedigrees and records of breeding stock, day-old chicks and eggs offered.

Table Poultry.—There has during the year been a good demand for table birds, again due to similar reasons as the increased demand for eggs. Prices vary from 7d. to 1s. 3d. per lb. The former price is much too low, and it is impossible to feed to killing age for this. It is considered that 1s. 3d. per lb. for well-fed, good fowls is not too high. The public have still a great deal to learn with reference to value, quality and nutritiousness of the well-fed fowl, and so long as they are content to purchase the poorly fed native fowl there is little hope for a table poultry industry and good nourishing white meat for the community.

Price of Eggs.—The price of eggs at some seasons of the year to the producer is much too low, and at others to the consumer much too high. A more uniform and rational price throughout the year to both consumer and producer should be aimed at. Those who have been in the business for some time and have weathered the storm, and who get good results from their birds, can make contracts at fair prices, as well as sell breeding stock, etc., at good prices.

Itinerant Work.—The itinerant work of this Division has this year been much more constant and extensive than in any previous year. The number of visits paid to farmers and poultry keepers total 479, and considerably over 20,000 birds have been individually handled, graded and mated.

Individual visits to poultry keepers and farmers are more valuable to them and to the poultry industry of the country than any other work of this Branch. Timely advice on the type and erection of houses, the best site and aspect necessary for these, often means the difference between success and failure. Information as to the correct method of feeding and the condition of the stock assists materially in breeding vigorous, healthy birds, and good egg records. More important even than the above is the work of culling, grading and mating, in order to produce the best possible stock, and this can only be carried out or demonstrated on the poultry keeper's own premises.

The number of poultry (i.e., fowls, ducks and turkeys) owned by 1,893 farmers is as follows:—In 1926, 157,288; in 1927, 156,428. Sales of eggs in 1927 totalled 343,604 dozen. In 1926 the total sold by farmers was 325,225 dozen. It will be noted that fewer fowls were owned by farmers (no statistics can be obtained from small plotholders and householders) in 1927 than in 1926, but a greater number of eggs were produced. The explanation is that many who in 1926 had fowls of the ordinary type neglected them for other industries, but those who had better laying quality fowls did not do so to the same extent. No figures are available as yet for 1928, but there is no doubt that the return will show a greatly increased number of fowls and eggs.

Poultry Shows.—Six were held during the year, viz., Salisbury, Bulawayo, Gwelo, Umtali, Rusape and Fort Victoria. Entries at all the shows were good, and the quality of the poultry showed further improvement. The larger breeders were well represented, but not the smaller ones nor the farmers. The majority of entries were in respect of utility birds.

The Departmental Show Exhibit.—This was staged at all the above Shows.

The Ninth Annual Egg Laying Test.—This commenced on 1st March, 1928, and concluded on 30th January, 1929. There were more entries than pens available (20), and some applications from the Union, according to the rules, had to be refused and others ballotted out. This has been the case since the inauguration of the laying test. The majority of the birds were good and well up to standard, and the laying and health have been good. There were four pens of Australorps (20 birds), five of Rhode Island Reds (25 birds), one of White Wyandottes (5 birds) and ten of White Leghorns (50 birds). The clerical work, calculation and records, etc., in connection with the test entail a considerable amount of work. One hundred and sixty-nine visits have been paid to the laying test during the year by one or other of the two Poultry Officers. As a demonstration to poultry keepers and farmers, this test is invaluable, and the breeding of better stock and increased egg production per bird throughout the country have to a large extent been the result.

Diseases.—It is gratifying to report that these are on the decrease, due to better housing, better hygiene and especially to poultry keepers taking advantage of having autopsies performed on their dead fowls. One hundred and ninety-five dead birds (fowls, ducks and turkeys) have been received by the Poultry Division during the year for examination, and as a result of autopsies performed on these birds, and advice being given, many epidemics have been nipped in the bud and much loss of stock been prevented. Another reason for the lessened amount of disease is the attendance of one or other of the Poultry Officers at the Salisbury Saturday morning market to examine fowls for sale to prevent any that are suffering from disease being sold and to order their destruction. Forty-three such visits have been paid during the year. It is gratifying to report that each year fewer birds suffering from disease are on sale at this market. An inspection of fowls sold in the towns would very considerably reduce disease and insect vermin. Notwithstanding the continuous efforts of the Poultry Division to reduce insect vermin (especially fowl ticks) among poultry, these pests are still prevalent, and are spread chiefly by native fowls, with the result that much good stock and the returns they would have brought in are lost to poultry farmers in the country. In some countries poultry inspectors are specially employed to reduce these pests.

Lectures and Demonstrations.—Ten lectures have been given to a total of 207 people, and five demonstrations, chiefly on caponising, to audiences of ten and upwards.

Much experimental and research work on diseases of poultry, and, in fact, on many other branches of poultry husbandry, could with advantage be undertaken if funds permitted this being done.

Staff.—I wish to place on record my sincere appreciation of the good work done by my staff. Their devotion to their duties has been all that could have been desired, and their services have always been gladly given at all times to further the interests of the poultry industry.

ARTHUR LITTLE,
Poultry Expert.

Annexure "E."

Report of the Tobacco and Cotton Expert for the Year 1928.

The extension and increase in the work of the Tobacco Branch indicated last year have been maintained during the year under review.

Although the majority of tobacco growers had previously produced at least one crop of tobacco, seasonal conditions were such that difficulty was experienced in the handling and curing of the leaf. Owing to these difficulties, experienced by new growers principally, the services of officers of this Branch were in constant demand.

In many areas throughout the Colony seasonal conditions were not particularly favourable during the transplanting season, and this, combined with the ravages of insect pests, rendered the maintenance of a good stand of plants in the field very difficult. Many fields were refilled from three to six times in order to secure a satisfactory stand of plants.

At a later stage in the season, when the crop was approaching maturity, the lack of rain was responsible for a certain deterioration in the quality of the leaf and a reduction in yield. In this respect the southern portion of the Colony was more adversely affected than Mashonaland generally. A few crops were ploughed under where it was found impossible to cure the tobacco satisfactorily, owing to the lack of rainfall at the critical period of growth.

A general experience during the curing season was the tendency towards "sponging" in the early curings, and difficulty in eliminating "green" during the latter half of the curing season.

The use of hot air induction, introduced by this Branch, was found to minimise the risk of "sponging" the leaf in flue-curing barns. This system of ventilation was adopted by a number of growers during the year.

Although climatic conditions were not ideal during certain stages, conditions generally were favourable enough to aid the production of the second highest acre yield and the greatest total output of Virginia tobacco so far recorded for Southern Rhodesia.

The incidence of most of the common diseases was not so serious this season as has been the case during certain seasons in the past. Owing principally to precautionary measures taken with the seed beds and the nature of the season being unfavourable to the spread of bacterial disease, both "blackfire" (*Bacterium angulatum*) and "wildfire" (*Bacterium tabacum*) were not very prevalent, and no serious losses were incurred through their agency. White mould (*Oidium*) was present in the crop towards the close of the season, and was responsible for a fair amount of damage. Mosaic disease still continues to take an increasing toll of the crop annually. It was present in every field of tobacco and adversely affected, in a varying degree, both the yield and quality of the leaf. Until the present time mosaic disease has not been regarded by the majority of tobacco growers as a serious disease, and for that reason few methods of control have been practised. The possible control of this disease is now receiving attention, but not to the extent warranted by its seriousness.

Table No. 1. PRODUCTION OF TOBACCO IN SOUTHERN RHODESIA, 1918-28.

	Virginia tobacco.			Turkish tobacco.		
Season.	Acres planted.	Yield in lbs.	Acre yield in lbs.	Acres planted.	Yield in lbs.	Acre yield in lbs.
1918-19	3,198	1,179,932	369	999	287,680	288
1919-20	5,546	2,435,994	435	1,958	511,633	266
1920-21	7,888	3,192,662	404	1,643	554,320	337
1921-22	9,007	2,880,104	318	1,167	302,255	259
1922-23	7,758	2,540,942	327	1,296	269,839	208
1923-24	7,001	3,426,390	489	1,002	452,070	451
1924-25	7,550	1,987,382	263	891	418,522	469
1925-26	13,160	5,813,186	404	755	346,623	459
1926-27	29,172	18,631,069	638	992	633,488	638
1927-28*	46,123	24,201,201	525	910	451,580	496

* The figures relative to the 1927-28 season are as stated by the Government Statistician. Owing to outstanding returns, the above-stated figures cannot be regarded as being finally correct. Actual returns received indicate:—Virginia tobacco, 42,720 acres, yielding 22,470,850 lbs., whilst outstanding returns are estimated at 3,403 acres, yielding 1,730,351 lbs. Turkish tobacco, 899 acres, yielding 447,580 lbs., whilst outstanding returns are estimated to be 11 acres, yielding 4,000 lbs. The average acre yield over the period 1918-28 is 417 lbs. Virginia and 387 lbs. Turkish tobacco.

Table No. 2. ACREAGE, YIELDS AND TYPES BY DISTRICTS. Season 1927-28.

	Virginia tobacco							Turkish tobacco	
	Total acreage	Total yield in lbs.	Total yield in lbs. flue cured	Total yield in lbs. fire cured	Total yield in lbs. sun cured	Total yield in lbs. air cured	Total yield in lbs. Inyoka	Total acreage	Total yield in lbs.
Wankie ...	30	5,000	4,000	...	...	...	1,000	..	...
Nyamandhlovu	300	135,000	135,000	...	...	...	...	20	10,800
Bulalima-Mangwe	33	10,800	6,350	...	4,450	...	...	10	900
Matobo ...	40	5,000	5,000	...	...	...	...	...	...
Umzingwane ...	23	4,000	2,920	800	280	..	...	...	...
Bulawayo ...	460	154,850	153,600	...	250	...	1,000	215	90,625
Bubi	103	13,200	9,200	...	...	...	4,000	3½	600
Sebungwe ...	...	...	...	...	..	...	...	...	...
Gwelo	2,118	570,097	489,247	...	..	...	80,850	23	4,280
Selukwe ...	176	84,000	83,000	...	...	...	1,000	...	...
Insiza	200	63,500	63,500	...	...	...	...	...	...
Gwanda ...	50	25,360	25,000	...	..	...	360	...	...
Belingwe ...	...	...	...	...	...	...	...	...	...
Victoria ...	207	74,732	74,518	...	...	...	214	...	...
Chilimanzi ...	277	119,534	118,734	...	...	...	800	...	...
Hartley ...	7,720	3,148,647	3,130,547	..	17,100	...	1,000	66	11,792
Lomagundi ...	6,645	4,777,777	4,764,627	9,050	2,500	...	1,600	436	266,000
Mazoe	8,003	4,300,922	4,241,922	59,000	...	...	...	112	60,000
Salisbury ...	4,741	2,660,439	2,641,144	18,295	...	...	1,000	2	300
Marandellas ...	4,259	2,478,040	2,478,040	...	..	...	...	...	...
Charter	368	153,750	150,500	...	3,250	...	...	...	...
Gutu	225	77,891	77,891	...	...	...	...	...	...
Ndanga ...	23	7,200	6,000	1,200	...	...	...	...	...
Chibi	...	...	...	...	...	...	...	...	...
Bikita	...	...	...	...	...	...	...	...	...
Melsetter ...	253	62,950	61,600	...	550	800	...	...	...
Umtali	258	142,684	133,984	5,200	500	3,000	...	4½	1,883
Makoni	4,613	2,576,953	2,576,853	...	100	...	...	1	400
Inyanga ...	53	26,800	26,800	...	...	..	...	6	...
Mrewa	979	616,724	616,724	...	...	...	...	...	...
Mtoko	2	...	...	...	...	...	...	...	...
Darwin	561	175,000	175,000	...	...	...	...	...	...
	42,720	22,470,850	22,251,701	93,545	28,980	3,800	92,824	899	447,580
Outstanding returns unallocated	3,403	1,730,351							
	46,123	24,201,251							

It will be observed from the foregoing tables that the acreage under Virginia tobacco was increased by 16,951 acres over last season's total. The increase in the total yield amounted to 5,570,132 lbs. over the preceding season and represents the approximate equivalent of the total output shown for the season 1925-26. The average acre yield, however, is 113 lbs. lower than that recorded for the 1926-27 season, which is the highest on record.

The acreage planted to Turkish tobacco shows a decrease of 82 acres and a drop of 181,908 lbs. in the total yield. The average acre yield is 142 lbs. lower than that obtained during the 1926-27 season, when the highest yield so far recorded was obtained.

During the year 1928 the officers of the Tobacco Branch made in all 3,198 visits to farms, attended 25 farmers' meetings, at which matters relating to tobacco were discussed; 10 lectures on tobacco culture were delivered, and numerous demonstrations in field work, curing and grading were carried out in various centres. Eight special meetings were attended during the year. All the Agricultural Shows held in the Colony were attended by the Tobacco and Cotton Expert, and tobacco exhibits were judged at each of the seven Shows held.

In the tobacco section of the Salisbury Agricultural Show one feature of special interest was an exhibition, arranged by this branch, of dummy containers displaying a great number of brands of Rhodesian and Rhodesian-Empire blends of cigarettes and tobacco manufactured in Great Britain. These empty containers were forwarded from England through the office of the High Commissioner for Southern Rhodesia.

The following articles were published in the *Rhodesia Agricultural Journal* and reprinted in bulletin form:—

"Harvesting and Curing of Virginia Tobacco." D. D. Brown, Tobacco and Cotton Expert.

"Turkish Tobacco Culture in Southern Rhodesia." D. D. Brown, Tobacco and Cotton Expert.

"Tobacco Growing in Southern Rhodesia." D. D. Brown, Tobacco and Cotton Expert.

There has been a very large demand for bulletins dealing with tobacco culture reprinted from the *Rhodesia Agricultural Journal.*

Towards the close of the year Rhodesian leaf was selling a little more freely, this movement synchronising with the publicity and advertising campaign inaugurated about that time. Several of the larger manufacturing firms introduced new brands of straight Rhodesian cigarettes and pipe tobaccos, which are being well advertised throughout Great Britain. Numerous brands containing Rhodesian leaf in blends with other Empire growths were also introduced by tobacco manufacturers in various centres. The use of our leaf by the larger firms of manufacturers will undoubtedly be of considerable assistance to the tobacco industry in this Colony. The smaller and less important firms of tobacco manufacturers are also capable of rendering valuable assistance through making use of our tobacco in the manufacture of cigarettes and pipe tobaccos.

If producers will profit by experience, the annual acreage should be subject to no violent fluctuation in future. It is desirable that all further increase in production should be commensurate with such expansion in marketing facilities as may be effected from time to time. When once our tobacco is firmly established and the quantity absorbed by each market is definitely known within reasonable limits, the risk of over-production or serious under-production can be reduced to a minimum.

A visit made to England by the Honourable the Minister of Mines and Works for the purpose of studying the problems relating to the marketing of Rhodesian tobacco resulted in advice being given to all tobacco growers to curtail production of Virginia tobacco during the forthcoming season. That this recommendation has been adopted is quite evident, though the extent of the reduction cannot yet be accurately ascertained. It is, however, estimated that the reduction represents approximately 65-70 per cent. of the acreage planted

in the 1927-28 season. Based on the above reduction, the acreage for the 1928-29 season is estimated to be from 12,000 to 15,000 acres approximately. A decrease of approximately 70 per cent. in the total acreage might appear to be a rather drastic measure; however, tobacco growers are to be commended for making an all-round curtailment, which should prove of material assistance in stabilising the industry in this Colony.

It must be borne in mind that any quantity of Rhodesian tobacco sold on the English market must displace a like quantity of tobacco which in the past has been supplied by other countries. The progress made in the marketing of Rhodesian tobacco is therefore largely dependent on the rate at which our leaf is made to supersede the product of other countries, some of which have been supplying Great Britain with tobacco for a great number of years.

The quality of Rhodesian leaf is well up to the average standard of our most serious competitors, and on this score is quite capable of selling on its merits. The main drawback is stated to be the question of flavour and rapidity of combustion. It may be possible to modify or eliminate either or both of these faults by suitable methods in the field and in the handling of the tobacco. The extent to which it may be possible to correct these, however, can only be arrived at through research. One special advantage claimed for Rhodesian tobacco is that it can be manufactured after being matured for 18 months, as compared with three years required for American tobacco.

With reference to the African markets, it is pointed out that the native has so far been regarded almost solely as a producer and not as a consumer. There would appear to be a very considerable potential market for cigarettes and tobacco specially prepared for native consumption, and very little concerted effort appears to have been made to foster this trade.

Resulting also from the Honourable the Minister of Mines and Works' visit to England was the tour undertaken by the Tobacco and Cotton Expert, accompanied by the Chief Chemist and the Mycologist, who visited Nyasaland for the purpose of making preliminary investigations into tobacco research which is being carried out in that Protectorate. During the month of September the above-mentioned officers travelled extensively over Nyasaland and studied the work being done by the Nyasaland Government and by The Imperial Tobacco Company. There it was found that the necessity for properly conducted research was fully realised and important work was in progress. A joint report dealing with this subject was prepared on completion of the above tour.

The production of Virginia tobacco is confined mainly to the flue-cured type, for which purpose the variety "Hickory Pryor" is almost exclusively used. There has been a tendency to introduce, on a commercial scale, other varieties, and this is to be discouraged. The export business is being built up on one type, "Hickory Pryor," and until a firm footing has been secured, the dilution of the bulk by the introduction of various other varieties may prove detrimental. The introduction of other varieties of tobacco can only be considered advisable after they have been proved by exhaustive experiments to be capable of producing leaf which may be more desirable than our present product, and when our tobacco market in Great Britain has been more firmly established. Fire-cured tobacco has been more widely grown, and the quantity produced is gradually being increased in those areas where soil and climatic conditions are found to be suitable. The quality of Rhodesian fire-cured leaf has been very favourably commented upon by buyers and manufacturers in England. It is anticipated that this type of tobacco will eventually reach considerable importance in our exports of tobacco to Great Britain. The demand for sun-cured and air-cured tobacco is not very great.

The acreage devoted to Turkish tobacco still remains fairly constant, and the output is sufficient for existing trade requirements of South African manufacturers. Further development can only be recommended when additional outlets for this type of tobacco are available.

The type of tobacco to which the general term "inyoka" is locally applied is leaf which, after being fermented, is formed into cones, balls or bricks for

native consumption. Tobacco under this heading usually comprises very low-grade leaf which cannot otherwise be disposed of. In certain areas native producers cultivate tobacco for the express purpose of making "inyoka." The substantial output of 92,824 lbs. of "inyoka" tobacco this year is due to the depressed state of the tobacco industry as a whole. European tobacco growers have disposed of their low-grade tobacco, which, manufactured into "inyoka," has yielded a certain amount of revenue. This policy, under the exceptional circumstances obtaining at the present time, is of no serious importance, but under normal circumstances deliberate production of low-grade tobacco on a large scale is to be deprecated.

The long continued reliance placed by tobacco growers on the cultivation of only one crop is now being modified to some extent. Tobacco will continue to be their principal crop, and the inclusion of other suitable farm crops will afford more security and tend to equalise the effects of adverse climatic and seasonal conditions.

D. D. BROWN,
Tobacco and Cotton Expert.

Annexure "F."

Report of the Cotton Specialist for the Year 1928.

During the season under review the acreage planted to cotton was the lowest since 1923, a state of affairs brought about by disappointing results obtained generally throughout the country over a period of three years. The figures obtained, through the courtesy of the Government Statistician, show that an area of 1,390 acres was planted, according to the number of returns rendered by all farmers who stated their intention to plant cotton. From the same source the total yield is reported to be 116,413 lbs. of seed cotton, which works out at an average of under 84 lbs. seed cotton per acre, the lowest average yield recorded in Southern Rhodesia.

A quantity of seven tons of cotton seed was imported from Natal by the Government in order to supply limited quantities to farmers who wanted to plant the crop, chiefly for rotational purposes. It was pointed out at the time that the seed was not of a jassid-resistant variety, and on that account not likely to produce remunerative crops. With few exceptions, such turned out to be the case.

As in previous years the exceptions were not confined to any one district, but were fairly well scattered throughout the country, and not restricted entirely to the low or middle veld. In fact, one such crop was raised within twenty miles of Salisbury, at an altitude of approximately five thousand feet.

Mention of this fact is merely made in order to point out that it is too early as yet to predict where cotton can or cannot be grown in Southern Rhodesia.

Until the new and early-maturing jassid-resistant U. 4 strain is available in sufficient quantity to be tried out in each district, great reserve should be exercised in making any pronouncement as to what are likely to develop into the more favourable cotton-growing areas.

Cotton Breeding Work.—The behaviour of the jassid-resistant Cambodia strain, which was grown for the first time on the station at Gatooma in 1926-27, fully justified the expectations which were then entertained. This variety matured so well when all other cottons failed to open properly that the chief obstacle to successful cotton-growing appeared to be solved.

Further proofs were necessary, however, before coming to any definite conclusions. These proofs fortunately were forthcoming, and the behaviour of the strain known as U. 4 in particular has gone far to demonstrate that cotton may yet be successfully grown in Southern Rhodesia.

Cambodia selections and jassid-resistant strains were markedly superior over other varieties, including a large number from the United States.

U. 4, a strain originally selected by Mr. F. R. Parnell, the Empire Cotton Growing Corporation's plant breeder at Barberton, in addition to being resistant to jassid, yielded a heavy crop of good, marketable cotton, which gives promise of being further improved by breeding up selected plants. This strain also withstood the very severe conditions which were experienced in February better than any other cotton on the station.

To what extent it can be improved by further selections it is not advisable as yet to predict. It may be safely stated, however, that many selections were made of plants which gave heavy individual yields, combined with superior lint length and high ginning percentage. How far these will breed true to type, as they are multiplied up on increase-plots, will not be known until the end of the ensuing season, when it is hoped that some of them at least will justify their retention as nuclei for future seed stocks.

Seed Supply for Farmers.—From 15 lbs. of U. 4 seed received from Mr. F. R. Parnell, approximately one ton of seed was produced at the end of the season on the Cotton Breeding Station. This seed has been distributed for farm multiplication to seventy farmers throughout the country.

Arrangements have been made whereby the farmers retain 25 per cent. of the seed obtained from their crops, the remaining 75 per cent. to be sold to the Government at a fixed price, for re-sale to cotton growers in 1929. What the return will be from the farm multiplication of this seed it is impossible to foretell.

If farmers will hand-plant in order to economise seed for the ensuing first year of general cultivation of U. 4, it should be possible to attain a total area of ten thousand acres.

Provided there are no severe and unforeseen attacks of bollworm, and a fair average season is experienced, the average indicated above might be trebled.

All that can safely be said at the time of writing the foregoing outline is that the seed which has been planted has germinated fairly well, and the outlook promises to be satisfactory.

Further Improvement and Supply of Pedigree Seed from the Cotton Breeding Station.—It is confidently expected that limited stocks of seed of improved strains will become available from the Cotton Station each year. The problem as to which is the best method to employ, in order to further bulk up such seed stocks, is one which is even now receiving consideration, but which will ultimately be adopted as being the one most likely to suit the country's requirements has yet to be decided.

G. S. CAMERON,
Cotton Specialist,
Empire Cotton Growing Corporation.

Annexure "C."

Report of the Chief Entomologist for the Year 1928.

AGRICULTURAL ENTOMOLOGY.

Major pests which have been recorded during the year include the following:

(1) **Cotton.**—Jassid (*Empoasca fascialis*, Jacobi), Stainers (*Dysdercus* spp.), Soudan Bollworm (*Diparopsis castanea*, Hmpsn.), "Wireworms" (*Trachynitus* sp.). The record in connection with Soudan Bollworm indicates that this pest is likely to prove a factor of importance in cotton growing in the Colony, although it has been little in evidence in the past. It was recorded from the Cotton Breeding Station, Gatooma, in large numbers in ratooned cotton and from the Shamva and Bindura sub-districts in annual cotton. Spiny Bollworm (*Earias* spp.) and American Bollworm (*Heliothus obsoleta*, Fab.) have also been recorded.

(2) **Tobacco.**—Complaints have been received of serious damage to seed beds by *ants* carrying off the seed, the following species being included amongst those causing this form of injury: (a) *Pheidole arnoldi*, Forel; (b) *Pheidole liengmei*, Forel; (c) *Pheidole prelli*, Forel; (d) *Pheidole tenuinodis*, Mayr.; (e) *Pheidole sculpturata*, Mayr.; (f) *Tetramorium sericeiventre*, Emery.; (g) *Tetramorium setuliferum*, Emery.; (h) *Messor barbaris*, var. *pseudoaegyptiaca*, Emery.

Other records have included Wireworms (*Trachynotus*, sp.), Leaf Miner (*Phthorimaea operculella*, Zell.), Stem Borer (*Phthorimaea heliopa*, Lwr.), Cutworms (chiefly *Euxoa segetum*, Schiff), White Grubs (one species of *Anomala exitialis*, Pering, was bred out), large Crickets and Root Gallworm (*Heterodera radicicola*, G.M.).

(3) **Maize.**—Much damage was done by the Maize Stalk Borer (*Glottula fusca*, Hmpsn.) to the 1927-28 crop, and a few complaints have been received this season. Other pests include Snout Beetles (*Tanymecus destructor*, Mshll.), "Wireworms" (*Trachynotus* sp.), Maize Rootworm (*Apophyllia murina*, Gerst.), Black Maize Beetles (*Heteronychus licas*, Klug., and possibly other species) and Army Worm (*Laphygma exempta*, Wlk.).

(4) **Ground Nuts.**—A considerable acreage of ground nuts on a farm in the Salisbury district was practically wiped out by white grubs belonging to the species *Eulepida mashona*, Pering.

(5) **Potato.**—Complaints have been received of attack by Cutworms (*Euxoa segetum*, Schiff) and of Tuber Moth (*Phthorimaea operculella*, Zell.) attcking the foliage and tubers.

(6) **Citrus.**—Apart from the usual scale insects, etc., *Thrip* has been prevalent, and the caterpillar *Heliothis obsoleta*, Fab., again put in an appearance this spring. Both species appear now to have established themselves as regular pests of citrus.

(7) **Miscellaneous.**—Chafer Beetles of various species have been particularly prevalent this season, attacking the foliage of deciduous fruit trees and rose bushes, and the blossoms of roses and other ornamental plants. Damage to deciduous fruits by Cetoniid beetles, chiefly *Pachnoda impressa*, Gold., and *P. rufa*, De Geer, has been the subject of several complaints this season. The numerous pests of the kitchen garden have been in evidence to the usual extent.

RESEARCH.

I. **Pests of Cotton.**—Experiments have been carried out with a view to ascertaining whether the presence of Jassid is necessary to produce premature reddening of the foliage of the Improved Bancroft variety. The results suggest a negative conclusion, but the experiments are not regarded as altogether conclusive. Some progress has been made in reference to the actual injury caused by Jassid to the cotton plant and also on the general bionomics of this insect. The stage in which this insect passes the dry season has, however, not been fully

elucidated, despite considerable effort. Attempts to find alternative food plants have also been unsuccessful, Jassids taken on other plants having all proved to be of other species. The difficulty of identifying Jassids with certainty greatly hinders this work, as material collected needs to be referred to a specialist, occasioning much uncontrollable delay.

Stimulation of cotton plants into early growth in the dry season (from August) by watering has failed to attract the insect, which has not put in an appearance on the growing plants till well after the commencement of the rains, i.e., late December or early January. Adult Jassids, reliably identified as *Empoasca fascialis*, Jacobi, have, however, been swept from herbage as late as August. Eggs were found freely in the wet season, but could not be found in the cotton plants in the winter.

Further progress has been made with study of the bionomics of the Cotton Stainer (*Dysdercus nigrofasciatus*, Stal.).

Experiments in May with poisoned bait against the adults of *Trachynotus* sp., the larvæ of which had caused serious injury to cotton at the Cotton Breeding Station, Gatooma, gave satisfactory results. Effective baits included a moist mixture of either Paris green or arsenite of soda and maize meal, covered over with foliage or other available material. Proportions used were (a) 1 lb. Paris green in 180 lbs. meal, mixed dry and moistened to a friable mash, and (b) 1 lb. arsenite of soda dissolved in 20 gallons of water and used to moisten maize meal to a friable mash.

II. **Pests of Tobacco.**—Pests of this crop which have received direct attention include the following:—(1) Dusty Surface Beetle (*Gonocephalum simplex*, F.) and other *Tenebrionidæ*. Reports were received that blood-meal in fertilisers attracted these beetles and occasioned loss. Tests at the Experiment Station afforded no support to the view, ants alone being attracted. (2) Wireworms (*Trachynotus* spp.). Field observations were made concerning date of emergence of adults. On sand veld near Salisbury the beetles were active during the latter part of April. At Gatooma on clay loam the beetles appeared early in May. Attempts at further breeding of these beetles at Salisbury failed. Field experiments with a proprietary soil insecticide and with *Potassium Xanthate* in reference to the protection of newly-planted tobacco against "wireworms" and other insects gave discouraging results. (3) Leaf Miner (*Phthorimaea operculella*, Zell.). Repetition of spraying experiments using arsenate of lead showed no protection against this insect, and thus did not support the results obtained last season. In this instance the plants were exposed to the weather, whereas last season they were protected. Further experiments are needed. A heavy outbreak of this pest in tobacco at the Experiment Station, Salisbury, in February yielded two parasites, the one an *Ichneumonid* and the second a *Braconid*. Percentage of infestation with the former reached as high as 50 per cent. This is the first record of parasites of this pest in the Colony. (4) Stem Borer (*Phthorimaea heliopa*, Lwr.). Observations in April on a field of Virginia tobacco near Salisbury, in which some of the plants had been treated for this pest by cutting off the stems below the point of injury and encouraging one sucker to grow, showed little, if any, difference between treated and untreated plants, the latter, of course, being also unattacked. The crop was of excellent quality and the plants very uniform. (5) *Ants*. Observations and experiments at a farm near Filabusi resulted in a decision that calcium cyanide powder was the most effective remedy against ants carrying off tobacco seed from seed beds. The planter reported later that he was able to keep his seed beds from serious injury by this method and succeeded in raising an abundance of seedlings. (6) Root Gallworm (*Heterodera radicicola*). Potassium Xanthate, potassium permanganate, calcium cyanide and sodium fluoride have been tested as applications to the soil in three seed beds against Root Gallworm, with discouraging results. (7) *Mosaic Disease*. This branch is collaborating with the Chief Botanist and Mycologist in experiments relating to the possible transmission of Mosaic Disease of tobacco by insects.

Tours of tobacco-growing areas by Entomologists last season revealed the fact that a large proportion of the farms had suffered losses from insect attack, chiefly Wireworms (*Trachynotus*), Cutworms and White Grubs (*Scarabaeidae*).

III. **Pests of Maize.**—Maize Stalk Borer (*Glottula fusca*, Hmpsn.). Records have been made of time of emergence of adult moths from the over-wintering borers. This appears to have been unusually late, probably due to meteorological influences. Trap crops were planted at the Experiment Station, Salisbury, and became infested in due course. The degree of protection afforded to the main plantings is not yet apparent. Burial of maize stalks infested with borer larvæ in loose soil at various depths resulted in no attempt on the part of the borers to make their way to the surface. Below two inches no moths reached the surface; even at two inches more moths failed than succeeded. Experiments were made involving removal of full-grown borer larvæ from the maize stalks to ascertain their behaviour. No attempt was made at any form of self-protection other than attempts to bore into anything which would yield to their jaws. Failing in these attempts, the larvæ all perished. Some experiments with "top dressing" maize against borer were carried out with two proprietary insecticides and Derris powder. All gave a satisfactory kill, but only the last-named failed to scorch the plants.

Attempts to hasten emergence of adult moths by exposing infested stalks to moist conditions gave negative results. The larvæ all died without pupating. Considerable infestation with a *Braconid* parasite was recorded in over-wintering borers in the open insectary. The parasite is thought to be *Bracon sesamiae*, and about 40 per cent. of the larvæ were attacked.

Field observations in August showed 7 per cent. only of stalks containing live borers in a crop which had been 90 per cent. infested. On one plot Termites had rendered 64 per cent. of stalks uninhabitable by filling them up with mud.

Experiments have been carried out with treatment of maize seed to protect it against insect attack. Nearly all substances tested affected the germination in a greater or lesser degree. These experiments are being continued.

One application of poisoned bait, consisting of arsenite of soda 1 lb., sugar 8 lbs., in 10 gallons of water, carried on chopped Napier fodder (*Pennisetum purpureum*), killed over 95 per cent. of Snout Beetles (*Tanymecus destructor*, Mshll.) in an infested maize field near Salisbury.

A petroleum oil spray diluted at 1 in 30 proved an effective contact insecticide for adult weevils (*Calandra oryzae*, Linn.) in an infested granary in Salisbury.

IV. **Miscellaneous Agricultural Pests.**—Large Crickets (*Maxentius pinguis*) were successfully poisoned by dipping weeds in arsenite of soda 1 lb., molasses 2 gallons and water 10 gallons, and distributing the bait about the infested ground. These crickets were attacking young *Eucalypts* near Salisbury. Field experiments with poisoned bait against Cutworm (*Euxoa segetum*, Schiff), using arsenite of soda (1 lb. in 20 gallons of water), Paris green (1 lb. in 5 gallons of water) and sodium fluoride (1 lb. in 5 gallons of water), gave results apparently in favour of (1) Paris green and (2) arsenite of soda. The arsenical poisons were carried on chopped Sow Thistle (*Sonchus oleraceus*), Spineless Cactus and other green stuff. The sodium fluoride was carried on chopped Spineless Cactus. The apparent result may have been affected by the slower action of the sodium fluoride. The baiting was successful on bare ground, but not in an infested potato field with growing plants. White Grubs (*Eulepida mashona*, Pering) were reared in the insectary from a badly infested crop of ground nuts and found to attack maize freely. Notes were made bearing on the possible cause of this outbreak, but the tentative conclusion reached calls for further corroboration.

MEDICAL AND VETERINARY.

Tsetse Fly.

I. **Operations in Lomagundi District.**—Owing to extension of the operations it is not possible to make a just comparison between the number of animals destroyed during the past year and the year before. Actually comparatively few animals have been destroyed in the old area, and although some slight invasion appears to have occurred across the Angwa River, game has on the whole been very scarce. This is particularly the case towards the Hunyani River.

Direct inspection with bait oxen extending over months has revealed odd flies in the old area, but less even than in 1927. The odd flies taken were

almost all associated with kaffir footpaths and kraals near traffic routes. No flies at all have been taken between the Mvume and Hunyani Rivers, although the area has been very carefully searched.

It appears probable that the old area is now as clear of tsetse as it is possible to make it, whilst fly exists in numbers immediately north of the old north (now middle) fence. Flies are at present bound to be carried in occasionally by travelling natives and vehicles from the fly area.

The improvement in the position on the formerly affected farms, which was recorded in 1927, has been more than maintained. On the east side of the Hunyani River all the farms reported free from trypanosomiasis in 1927 have remained free, and even on the northernmost farm nearest the definite fly area five spans of oxen are now at work and reported in good health. This farm was formerly the worst affected of all. Three cases of trypanosomiasis in cattle on this farm were recorded early in the year, but two were probably old "recovered" cases. There is some traffic to this farm from the fly area.

Between the Hunyani and Angwa Rivers, directly south of the fenced zone, one farm has shown little if any improvement—a fact very difficult to explain, as direct inspections of an intensive nature carried out in 1927 and during the past year have failed to reveal tsetse fly either on the farm or in the vicinity. On no other farms in this area have cases been recorded in animals which have not been off the farms and are not under suspicion of having been exposed to tsetse fly elsewhere.

Close and prolonged inspection with bait oxen failed to reveal any tsetse fly south of the fenced zone between the Hunyani and Angwa Rivers.

The complementary operations against game in the Sipolilo sub-district proceeding under the direction of the Assistant Native Commissioner appear also to have brought about considerable improvement in the position. The Assistant Native Commissioner, Sipolilo, summarises the record of the year as follows:—

1. There were no deaths due to tsetse fly.
2. Sipolilo Reserve is free of fly.
3. Fly are decreasing between Impinge and Hunyani Rivers, south of Mt. Barawari.
4. Game is diminishing.

The number of animals shot in this area during the year, however, shows far less decrease than in the fenced zone, a fact which seems to illustrate the efficacy of the game fences.

South of the Nyamsenzi-Sipolilo footpath an inspector with bait oxen failed to find any tsetse fly, although odd flies have been found in this region each year since 1923. This is probably the result of extension of the operations since 1927 into the triangle formed by the old north fence and the Mvume and Hunyani Rivers.

On the whole the position in connection with the operations in the Lomagundi district may be said to be distinctly encouraging. The advance of the fly has stopped and the majority of the farms have been saved from evacuation. Considerable areas where cattle were dying freely from 1923-26 are now supporting healthy herds. Direct inspection during the past two years indicates appreciable retrogression of the tsetse fly. The main factor now preventing a complete "clean up" appears to be uncontrolled traffic.

The new game fence cutting off a further ten mile zone immediately north of the old zone was completed in November. The end of the zone towards the broken country along the Angwa River is closed by a cross fence. At the eastern end the fence extends to the Impinge River, near Sipolilo, so that the open end of the zone extends into the country depleted of game by the natives operating under the direction of the Assistant Native Commissioner.

Operations in the new zone commenced in June with a view to driving as much game as possible out of the area previous to erection of the fence.

II. **Operations in the Catooma Sub-District.**—The western fence and the southern connecting fence were completed in April. Operations against game have been continued vigorously throughout the year and the fences have been

maintained in good order. A number of breakages occurred during the first part of the year, but for the last five months no breakages have been recorded, although the Ranger has patrolled the whole line each month. A great falling off in the number of animals destroyed is apparent in the December report, compared with last year.

Figures have again been collected bearing on the distribution and prevalence of tsetse fly in the fenced zone.

Definite improvement in the position in this district is clearly not to be expected as yet, in view of the heavy infestation of much of the fenced zone and the fact that the fences were only completed in April.

Notes are being kept of the incidence of trypanosomiasis in this region.

A special inspection of the country south of the fenced zone has revealed the fact that fly has more or less established itself near the junction of the Mzoe and Umniati Rivers, and is thus tending to outflank the area of operations and threatening a new block of farms. It is therefore proposed to extend the eastern fence and the operations as far south as the Umsweswe River.

III. **Effect of Grass Fires.**—An Entomologist proceeded to the fly area in Lomagundi in June to collect information concerning density and distribution of tsetse fly, percentage of emergence from puparia, etc., with a view to a second test of the effect of an organised grass fire at the end of September. He remained in the area until the end of November.

The grass-burning was carried out in due course on 29th September, but is reported not to have been as fierce and complete as last year. This is attributable to (1) failure of the wind later in the day, and (2) poor growth of grass in the forest during the unfavourable season of 1927-28.

The result of the fire appeared even less encouraging than last year, the effect on the puparia and density of the adult flies being apparently negligible from the practical standpoint.

It is to be noted that so far it has only been possible to test the *immediate* effect of these fires on the flies and the puparia. Experiments on a large enough scale to ascertain possible *indirect* effects cannot be carried out on a proper basis with the staff available.

Progressive decrease in the density of the flies during the dry season was again noted in this area, and the cause remains obscure. It is apparently not due to parasitic enemies.

Regular records were also kept concerning the percentage of flies infected with *Trypanosomes*, the latter being divided into groups according to the regions infected. Examination of gut contents in reference to food revealed mammalian blood almost exclusively, only one case of avian blood being recorded.

IV. **Wankie District.**—Cutting the evergreen trees along the Gwaai River with a view to creating a barrier against encroachment of tsetse fly was commenced in July and discontinued on instructions at the end of October after some ten miles of one bank of the river had been cleared. An alternative proposal submitted by this branch, involving establishment of settlement along the banks of this river on the basis of free occupation of farms with a prospect of free title, has received the approval of the Government and is to be put into effect.

Inspection of the region north of the Gwaai-Shangani junction showed the fly to be spreading in the direction of the Gwaai River and to be very close to the river between that junction and a point about three miles south of Hojokwe Hill.

An inspection of the scene of operations against game, 1919-22, by a temporary officer, as well as brief personal observations by the Forest Officer and myself in August, revealed a notable increase of both tsetse fly and game since the termination of the operations and my last visit to this region in August, 1923. The position in respect to both game and fly appears to be much as it was before the operations mentioned commenced. Fly was met with freely south of the Shangani River. Late in the dry season, drought conditions throughout the Colony generally had apparently concentrated phenomenal quantities of game

in this region, including elephant, rhinoceros and buffalo, with the usual species of antelope, etc.

V. **Occurrence of Glossina morsitans close to Melsetter Border.**—Five specimens of tsetse flies stated to have been taken on a buffalo shot about two and a half miles from Spungabera, on the Mt. Selinda-Gogoio footpath, were submitted to this branch by the District Veterinary Surgeon, Melsetter, in October. The specimens were found to consist of two *Glossina brevipalpis*, two *G. pallidipes* and one *G. morsitans*. The occurrence of *G. morsitans* in this region has never before been recorded, and it is hoped to arrange for a further examination of the locality to ascertain if this species is actually becoming established there. It is probable that this species constitutes the most active threat in reference to invasion of the southern part of Rhodesian territory from Portuguese East Africa.

Considerable losses of cattle from trypanosomiasis were reported on a number of farms south of the Lusitu River during the first half of the year. Some of the localities affected lie in the Sabi River Basin, remote from the border.

VI. **Sabi River Valley.**—There has long been reason to suspect the Sabi River Valley of harbouring tsetse fly, and a detailed search for fly in this region is considerably overdue. Diagnosis during the year of trypanosomiasis in an ox near the Tsungwesi-Sabi junction, a locality far remote from any known fly belt, emphasised the need of an inspection, and an experienced temporary field officer of the Branch has been detailed to examine the valley from this point down to the Portuguese border.

VII. **Parasites of Flies Allied to Tsetse.**—An Entomologist has devoted considerable attention to this question during the year. The work has been carried out (1) in the potential fly area in the Gatooma sub-district, close to the present fly limit, (2) at Salisbury, and (3) in the fly area in Lomagundi during November. In the Gatooma sub-district the investigation was a continuation of that mentioned in last year's report.

So far only two minor parasites have been found common to *Glossina* and allied flies.

Incidentally much information has been gained concerning the early stages of flies breeding in dung, decaying vegetable matter and carrion, and notes have been made bearing on their breeding habits.

VIII. **Control of Traffic from Fly Areas.**—The danger associated with traffic from the fly areas is certainly real, although there may be a tendency to overestimate it. Of recent years the danger has increased, owing to motor vehicles being used more freely for prospecting, etc. The question has received consideration, and certain recommendations have been made.

IX. **Co-operation of other Departments re Tsetse Fly Control.**—Discussion with other departments has been initiated concerning the possibility of creating barriers against tsetse fly encroachment through (1) concentration of native settlement, and (2) European settlement. It is hoped that in certain localities it may prove possible to proceed on a definite plan along these lines, but the procedure is fraught with considerable difficulties and is far from applicable to all threatened areas.

X. **Former Limits of Tsetse Fly.**—Attempts to obtain further information under this head, more especially in the southern part of the Colony, have been attended by considerable success. Collection of information concerning the characteristics of the country near the reported former limits appears likely to lead to an increase in our knowledge of the factors influencing the distribution of this insect.

In the above connection I take the opportunity of expressing my warm appreciation of the assistance afforded by various Native Commissioners in supplying information either from personal experience or culled from native sources.

Preservation of the Natural Fauna of the Colony.

Recommendations concerning the creation of a game reserve in the Wankie district were given effect to during the year, and on the 1st October, 1928, the first official Game Warden in the Colony was appointed. Temporary headquarters have been established near Dett Station, and the warden's first duties consist in exploring the reserve and obtaining information concerning the habits and movements of game.

Preliminary investigations have been made concerning the possibility of augmenting the water supply in this dry area, with a view to removing the necessity for migration of the game in periods of intense drought. A considerable improvement in the position appears possible at a reasonable outlay.

Suggestions that an area around the Chipinda Pools on the lower Lundi River should be set aside as a game reserve led to a joint visit to this region by the Forest Officer and myself in May. In view of very definite information obtained from native sources concerning heavy infestation of this area with tsetse fly prior to 1896, I was unable to recommend its maintenance as a game reserve. The country is typical of the low veld fly areas, with mopane forest predominating, and in the face of the steadily intensifying threat of eventual invasion by tsetse fly from Portuguese East Africa, creation of a game reserve in this region would appear to be a very short-sighted procedure.

Nurseries Ordinance, 1909.

Thirty nurseries have been registered and inspected in due course during the year.

Importation of Plants Regulation Ordinance, 1904.

The following consignments have been dealt with by the Plant Inspectors at the various ports of entry:—

Salisbury	2,092
Bulawayo	5,721
Umtali	409
Gwelo	485
Total	8,707

One hundred and twenty-two special permits for the introduction of plants, etc., into the Colony were issued during the year.

Annual permits issued to nurseries in the South African Union totalled sixty-six.

A whole-time Plant Inspector was appointed at Bulawayo on the 23rd January.

Regulations in Other Countries Affecting Export of Plants from Southern Rhodesia.

Thirty-one certificates of cleanliness have been issued in respect to plants intended for export to other countries. Three permits have been issued for the export of cotton to the South African Union.

"Rhodesia Agricultural Journal."

The following contributions have been made to the *Rhodesia Agricultural Journal*:—

(1) The Lesser Tobacco Wireworms. One full page black and white illustration. April.

(2) Ticks Infesting Domestic Animals in Southern Rhodesia. Two plates and one diagram. May-June. (A reprint of a former article very slightly revised.)

(3) Notes from the Entomological Laboratory. Trap Cropping for Maize Pests. November.

Agricultural Shows.

The Entomological exhibit was placed on the benches at the Agricultural Shows at Fort Victoria, Gwelo, Bulawayo, Umtali and Salisbury, with officers of the branch in attendance.

Farms Visited.

Farms visited by the staff during the year totalled one hundred and sixty.

Lectures.

Mr. Roberts.—

Tobacco Experiment Station. 16th October. *Control of Insect Pests.*

Self.—

Enterprise Farmers' Association. 11th January. *Maize Pests.*

Darwendale-Trelawney Farmers' Association. 22nd February. *Tobacco Pests.*

Salisbury South Farmers' Association. 28th November. *Control of Insect Pests.*

Umvuma Farmers' Association. 30th November. *Control of Insect Pests.*

Staff.

I much regret to record the death, due to a motor accident, of Mr. A. Leask, who was employed as Plant Inspector, Bulawayo.

A Game Warden has been appointed in the newly created Wankie Game Reserve. The field staff has otherwise consisted of two rangers in charge of the tsetse fly operations in the Lomagundi and Gatooma districts respectively and two other field officers employed throughout the year. Five further Europeans have been employed in connection with fence erection, forest destruction and tsetse fly inspection during a portion of the year (one for a few days only).

I have great pleasure in testifying to the loyal co-operation of all members of the staff during the year.

RUPERT W. JACK,
Chief Entomologist.

Annexure "H."

Report of the Branch of Chemistry for the Year 1928.

General.—The activities of the Division of Chemistry during the past year have been principally confined to more or less routine analytical work, together with educational and advisory work by correspondence and interview.

The call by farmers for the assistance of the Division in analysing their soils and guidance as to the best manurial treatment to apply to them has been particularly heavy. It is gratifying, however, to find that many of the most progressive farmers in the Colony year after year seek the advice of the Division and follow the principles and practices laid down for them, with benefit to themselves and to the community generally. That the Division can be of great assistance in helping the farmer to make the best use of his soils and in expending his money in the purchase of fertiliser to the best advantage is becoming much more generally realised.

Advisory work in connection with soils and fertilisers naturally constitutes the major activity of the Division, but in addition to this, as in the past, considerable call for chemical service has been made by other Departments of the Government, and hence the range of chemical work covered frequently extends considerably beyond that of the sphere of ordinary agricultural chemistry.

The ordinary routine work under the present organisation that the Division is called upon to undertake consists of the following:—

1. Analyses of samples taken under the Ordinance governing the sale of fertilisers and farm foods.
2. Standardisation of glassware under the "Dairy Produce Act, 1925."
3. Cattle dip and toxicological analyses for the Veterinary Department.
4. Analyses of soils, waters, manures and farm foods sent in by farmers.
5. Advisory work by correspondence and interview on problems coming within the sphere of the Agricultural Chemist.

Summary of Routine Analyses.—A list of the routine samples received and analysed during the year is presented in the following table:—

Soils	296
Sub-soils	39
Manures and fertilisers	42
Cattle dipping fluids	15
Farm foods	3
Toxicological analyses	87
Vegetable products	153
Waters	3
Limestones and rocks	14
Miscellaneous	13
	665

Soils.—Of the two hundred and ninety-six samples of soil received for analysis during the year, sixty-three were submitted by the Department of Lands. These samples represented virgin soil from Government farms in newly-surveyed areas, and reports were requested as to the inherent fertility of the soils and their probable suitabilities for tobacco and other crops. The other samples were submitted by farmers, and in the majority of cases information was desired as to the suitability of the soils for particular crops and for advice as to manurial treatment. None of these "routine" samples presented abnormal features of sufficient importance to call for special reference.

Manures and Fertilisers.—Forty-two samples were analysed during the year, of which twenty were sampled under the Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance. In view of the large progressive increase in the sale of fertilisers in the Colony, it was decided last year to enforce more stringently the

regulations laid down in the Ordinance, and with this object in view official samplers were appointed in the towns of Bulawayo, Gwelo, Gatooma and Umtali.

Farm Foods.—Only two farm foods registered under the Act were analysed, and both were found to conform to their guarantee.

Standardisation of Glassware.—No glassware was submitted for standardisation as required under Government Notice No. 279, 27th May, 1927. This may possibly be due to the creameries purchasing glassware from the Union of South Africa which has already been standardised by the Union authorities.

Cattle Dips.—Fifteen samples were analysed and reported upon, of which eight were performed for the Veterinary Department under the "Cattle Cleansing Act, 1927."

Toxicological Analyses.—Of the eighty-seven samples analysed under this head, sixty were samples of viscera obtained from cases of suspected poisoning.

In thirty-nine of these cases poison was found to be present and in thirty-six of the cases arsenic was the poison found. The poisons in the other three cases were respectively: cyanide, strychnine and nitrate of soda.

The mortality among cattle due to arsenical poisoning appears to be very high, and in nearly every case is caused by careless handling of strong arsenical dips.

The number of toxicological analyses performed by the Division gives no indication of the number of actual losses occurring among stock, as often many cattle are reported to have died and only one sample of viscera is submitted for analysis to confirm or negative the *post-mortem* findings.

In a very recent case it was stated that fifty-four head of cattle had died and many more were ill and had presumably been poisoned. Investigation into this case showed that the cattle were being smeared with what was supposed to be a mixture of paraffin, petrol and oil, but was in reality a mixture of paraffin, oil and strong arsenical dip.

Other cases occur where strong dip has been spilt on the earth and cattle have died from eating this soil. Cases of this kind are undoubtedly due to salt craving in the animals and it is almost certain that arsenic spilt on the ground on a farm will ultimately take its toll among the cattle.

The potency of arsenite of soda as a poison does not seem to be sufficiently realised, and careless handling of such a deadly poison on the farm will undoubtedly lead eventually to serious losses of live stock.

Vegetable Products.—Included under this head are a number of samples of tobacco submitted by the Tobacco Warehouse for the determination of the moisture content. In addition to these, a number of tobaccos were subjected to a complete analysis to ascertain the difference in chemical composition between Rhodesian and American tobaccos. The results of these analyses show points of marked difference between the mineral composition of the two types of tobacco, and indicate the lines on which research might be successful in fertilising the crop so as to improve the burning qualities of the tobacco from the manufacturers' point of view. A number of indigenous grasses were also subjected to a complete analysis to determine their respective feeding values, the seasonal variation in their composition and the influence of applications of fertiliser on their chemical composition. Comparative analyses between sweet potatoes and edible canna were made for the Agriculturist in order to determine which of these two products is the more economical to grow from a feeding point of view.

A number of samples of tobacco leaf were also analysed for the Mycologist to determine whether any influence was exercised on the sulphur and copper content of the leaves by application of sulphur to the soil and a copper salt to the plants as preventatives against certain tobacco diseases.

Determinations of arsenic on the leaves of tobacco plants from lead arsenate sprayed seed beds at different intervals after spraying were made for the Division of Entomology.

There are many points in connection with the above problems which need further investigation, but it is not possible to carry this out until additional staff is available. A number of analyses under this head were also carried out for local firms, for which fees were charged.

Waters.—Three samples of water were analysed during the year and advice rendered as to their suitability for agricultural purposes.

Lime and Minerals.—Fourteen samples were submitted under this head, consisting chiefly of travertines. Advice was usually desired as to their suitability for agricultural purposes.

Miscellaneous.—The samples analysed under this head numbered thirteen. They include samples of asbestos waste, blood, milk, pig feed, vegetable food refuse and a mineral salt.

Investigational Work.—The amount of investigational work carried out by this Division during the year under review has of necessity been very limited, owing to the whole-time attention of the staff being required to cope with the routine and administrative work of the Division.

The following experiments are at present in progress:—

1. Citrus fertiliser trials which were laid down in 1923 are being carried out in collaboration with the British South Africa Company on their estates at Mazoe and Umtali.

2. Experiments in soil treatment and manuring for maize production at the Salisbury Experiment Station.

3. An experiment to determine the relative influence on the yield of maize of a mixture of bone and superphosphate compared with raw rock phosphate was commenced on an extension plot at the Salisbury Experiment Station in December, 1926.

It is hoped that interesting and definite data will be obtained from this experiment during the coming season, and the results should be of both academic and economic importance.

4. An experiment to determine the value of asbestos waste as an ameliorant for soil acidity was laid down at the Government Farm, Gwebi, in October, 1927. From earlier work carried out in Canada it was believed there were indications that the dust produced in the milling of asbestos exercised a beneficial effect in this respect.

From the results so far obtained at Gwebi no influence has been discovered in the acidity of the soil as determined by its hydrogen-ion concentration, and a similar result has been obtained from more recent work carried out by the Dominion Chemist in Canada. This experiment is being continued over the next season, but if no further result is obtained the experiment will be discontinued.

Research into the Improvement of Natural Pastures.—A preliminary experiment was carried out at the Salisbury Experiment Station to determine the influence of an application of complete fertiliser on the percentage composition of veld grass. The results of this preliminary experiment were published in the September number of the *Rhodesia Agricultural Journal*.

The results obtained were very encouraging, and indicate that a marked difference in both the mineral composition and the feeding value of the grass can be effected by fertilisation.

The information gained in this experiment will be of great assistance when drawing up the scheme of experimental work which will definitely be commenced during the present year (1929) on research into the improvement of natural pastures. It is of great satisfaction to this Division to know that the Empire Marketing Board have agreed to assist in financing this research on the £ for £ basis, and that the scheme of research as drawn up by this Division met with the complete approval of the Empire Marketing Board.

The lines along which research into pasture problems will proceed in this Colony are somewhat similar to those which are at present proceeding in South Australia, and it is of interest to note that one of the team of research officers

from South Australia working on these problems was sent here by the Empire Marketing Board at the beginning of the present year to establish personal touch and to discuss pasture problems in South Australia and Southern Rhodesia.

It is hoped that by co-ordination of the research work on pasture problems in different parts of the Empire unnecessary overlapping will be avoided and results obtained will be of benefit not only to the country carrying out the work, but also to the Empire as a whole.

Travelling.—Five farmers' association meetings have been attended and a lecture delivered at each upon fertilisers and the maintenance of soil fertility.

Eighty different farms were visited, by request, during the year. Many applications from farmers' associations for personal visits by an officer of this Division to its members have been received, but as these requests did not reach this office until the end of August it has not been possible to comply with many of the requests, as the latter part of the year is always a period of great pressure of laboratory work.

Two lectures were given to pupils at the Salisbury Tobacco Experiment Station.

Members of the staff were in attendance at the Agricultural Show held in Salisbury to explain the exhibits of the Division.

The Chief Chemist, by direction, proceeded to Nyasaland in September in company with the Chief Tobacco Expert and the Government Mycologist for the purpose of enquiring into the position of research on tobacco problems being carried out in that country by the Government officials and the officers of the Imperial Tobacco Company.

A joint report on the results of this visit was forwarded to the Secretary, Department of Agriculture, in October.

Publications.—One article, "The Importance of Research on Pasture Improvement in Southern Rhodesia," was published in the *Rhodesia Agricultural Journal*.

Staff.—No changes of staff have occurred, and with the exception of absences due to sick or occasional leave, the staff has been at full strength during the year.

I desire to record my appreciation of the loyal and efficient service rendered by my staff, to whom the accomplishment of the great amount of analytical work is due.

Acknowledgment is also made to the Manager of the Salisbury Experiment Station for the energetic and painstaking manner in which he has carried out the field experiments in the investigational work recorded above.

A. D. HUSBAND,
Chief Chemist.

Annexure "I."

Report of the Forest Officer for the Year 1928.

Introduction.—The year under review has been one of steady progress. The decision of Government in 1927 to purchase Stapleford Ranch resulted in the estates being formally taken over by the Forest Service on 15th February. It was not until May that a workable labour force was recruited, but after that date the laying of the foundations of what must eventually be a valuable forest reserve steadily proceeded.

The modest goal of establishing 500 acres of trees during the first season was aimed at, and the staff concerned carried out their duties with such enthusiasm that there is now the definite assurance that the figure will be exceeded by over 100 acres.

The Mtao Forest Reserve has now passed the initial stages of experiment, and extensive afforestation can be carried out with a comprehensive range of valuable hard and soft woods.

The care with which the site was chosen has amply justified itself, for the great depth of soil, assisted by rigid fire protection, has enabled the existing plantations to weather the last two drought years, the dire effect of which is seen all over the Colony wherever soils of comparative shallowness occur.

The European labour scheme at Mtao is making satisfactory progress, and the behaviour of the men has, in general, been good.

Three mild outbreaks of dysentery and four minor operations in hospital were all that marred the otherwise clean health bill of the men.

On the 1st January there were 39 men in camp; 79 men reported for work and 63 departed during the year, leaving a total strength of 55 at the end of December.

The Forest Nursery, Salisbury, continues to give excellent service to the general planting public. The revenue returns are higher than any previous year, despite the losses occasioned by the failure of the water supply. Fortunately this deficiency has now been rectified by the sinking of an additional high yielding borehole.

The recommendation of the Lands Commission, 1925, Report to declare an area of 670,000 acres in the Nyamandhlovu, Bubi and Wankie districts as a State Forest Reserve has not yet been put in force. The experience gained during the last three-and-a-half years places the Forest Service in a position to treat the Kalahari Sand Forests in a systematic and business-like manner as soon as effect is given to the recommendation of the Lands Commission.

State Forests.—The area of State Forest Reserves comprises:—

Forest Nursery, Salisbury	100.00	acres.
Mtao Forest Reserve	15,498.37	,,
Stapleford Forest Reserve	18,420.30	,,
	34,018.67	,,
Gwaai Forest Reserve (proposal)	670,000.00	,,
Total	704,018.67	,,

Fencing.—The boundary between the Mtao Forest Reserve and the Driefontein Mission, 2 miles 198 yards in length, was fenced with wire by the Mission. Half the cost was borne by the Reserve.

General Management.—At the Mtao Reserve compartments are surveyed and permanently marked with numbered posts well in advance of planting. Twenty compartments, totalling 400 acres, were surveyed during the year.

In the Kalahari Sand Forests no new areas were surveyed, but fresh interior lines in the existing working sections have been marked on the ground to serve as block boundaries.

At the Stapleford Reserve a tacheometer contour survey of 920 acres was made in Block A. A map showing 20 feet contours was prepared, and 26 compartments, totalling 742.55 acres, were marked on the ground and numbered. The southern and western boundaries of the Reserve between farms Harrisville and Walmer were marked on the ground.

Following the usual forest practice, annual plans of operations are drawn up for each field station, prescribing operations to be carried out during the financial year.

At Fairfield, Mtao, the work prescribed is well in hand.

At the European Relief Works, Mtao, the severe drought prevented the complete planting programme for the 1927-28 season from being carried out.

At the Stapleford Reserve, on account of lack of data, an annual plan of operations was framed on conservative lines. In the case of communications, little was done in road-making, but the programme of bridle paths construction in Block A was completed. It is gratifying to record that 83 more acres were prepared for planting than prescribed for the whole financial year, and it is intended to prepare a further 50 acres before the 31st March of the ensuing year.

In the Kalahari Sand Forests the annual plan was adhered to in a general way, but in view of shortage of European supervision, minor operations were reduced to a minimum in favour of more intense fire protection.

Protection.—The usual precautions were taken in all the reserves by burning and clearing fire belts and by system of patrol to protect the forests from fire.

At the Mtao Reserve three fires occurred in the indigenous forests. The largest fire, which burnt 157 acres, was occasioned by the carelessness of a white labourer, who was subsequently dismissed.

The total area burnt was 232 acres, or 1.5 per cent. of the area of the Reserve. This small percentage is considered very satisfactory in view of the drought conditions which prevailed.

As has already been pointed out, operations in the Kalahari Sand Areas are mainly confined to fire protection.

Three large areas, the Masue, Fuller-Kesi and Umgusa Working Sections, situated between Sawmills and Victoria Falls, which were previously surveyed and protected, were again protected during the year.

It was felt, despite the magnitude of the task, that it was better to endeavour to protect large areas by measures which would secure the forests against ordinary fires than to adopt intensive measures over a small area.

The results appear to have justified this choice, as the following table will show:—

Working section	Area protected		Area burnt		Percentage burnt
	Square miles	Acres	Square miles	Acres	
Masue	210	134,400	15	9,600	7.1%
Fuller-Kesi ...	90	57,600	7	4,480	7.7%
Umgusa	211	135,040	47	28,800	21.3%
Total	511	327,040	67	42,880	13.1%

Despite the satisfactory figure showing that only 13.1 per cent. of the protected area was burnt, it must be admitted that the element of chance played an important part.

Fire protection means the saving to the country of millions of valuable indigenous trees, and the very definite assurance that these trees will give timber of better quality each year.

At Mtao Forest Reserve the damage to young trees from spring hares previously experienced was negligible during the year, as precautions were taken to erect low brushwood fences and to shoot out and hunt the pest.

Eucalyptus maculata, Euc. citriodora and *Euc. microcorys* suffered badly from frost, but have since recovered.

All the young trees planted at Fairfield stood the drought remarkably well, but at the European Relief Works young conifers suffered great mortality, as very little rain fell after their being planted in an already dry year.

At the European Relief Works crickets caused considerable damage during the early part of the year.

In the Kalahari Sand Forests caterpillars belonging to the order *Saturniidae* made their annual appearance on *Burkea africana* and *Gleditschia africana*. Very extensive areas of these trees were defoliated.

Frosts in this area were not severe during the year, except in the vicinity of vleis.

Sylviculture.—(a) *Natural Regeneration.*—At the Mtao Reserve germination of seedlings was checked by drought. In the Kalahari Sand Areas seedlings of *Baikiaea plurijuga* and *Afzelia cuanzensis* germinated freely towards the end of the year.

In both these areas indigenous trees flowered and fruited abundantly during the year.

Of exotic trees at Stapleford Reserve, *Eucalyptus saligna, E. botryoides, E. microcorys, Cupressus lusitanica, Callitris robusta, Quercus pedunculata* and *Acacia mollissima* all reproduce very easily from seed. *Populus alba* is spreading vigorously by means of suckers.

(b) *Artificial Reproduction.*—Afforestation operations during the year were as follows:—

Station	Afforested area at the end of 1927	Afforested area during 1928	Total area afforested at end of 1928
	Acres	Acres	Acres
Forest Nursery, Salisbury ...	36.50	...	36.50
Mtao Forest Reserve:			
(*a*) Fairfield	455.50	183.09	638.59
(*b*) European Relief Works ...	181.00	142.00	323.00
Stapleford	45.00	...	45.00
Totals	718.00	325.09	1,043.09

Forty-five acres of various exotic trees had already been established when the Reserve passed into Government hands.

No planting was done during the year, as operations were concentrated on preparing for planting the whole of the prescribed area. Some 583.44 acres were prepared and will be planted during January and February of the ensuing year.

Cultural Operations.—At the Mtao Reserve cultural operations have been further simplified and cheapened by eliminating ploughing. The method now

followed is clear stumping, burning felled trees and scrub *in situ*, followed by harrowing. To be entirely successful the method necessitates clear stumping a year in advance of burning. After these operations, holes are dug and filled with top soil.

At the Stapleford Reserve, because of the danger of soil erosion, the method adopted was to hoe patches 2 feet 6 inches square, the patches being roughly 6 feet apart. On land with a gentle slope the patches were marked with a linked wire suitably marked.

Nurseries and Sales of Seeds and Transplants.—The sales at the Forest Nursery again exceeded those of any previous year. During the year 436,134 transplants, mainly of timber trees, and 339 lbs. 9 ozs. of seed were supplied. The nursery stock on hand at the close of the year was 246,500 transplants valued at £1,080 10s., and 70 lbs. of seed, value £52 10s.; total, £1,133.

At the Mtao Forest Reserve the Fairfield Nursery distributed 419,519 transplants and 14 lbs. 10 ozs. of seed, and had on hand at the end of the year 348,214 plants, valued at £939 16s. 6d.

The nursery at the European Relief Works distributed 224,800, and the stock on hand at the end of the year was 2,085,000 transplants, valued at £769 10s.

At the Stapleford Forest Reserve a nursery was established during the year, and 792,000 pricked out plants were raised at a cost of 5s. 6d. per 1,000. The cost does not include white supervision and purchase of seed.

No plants were sold or planted out, and the stock on hand at the end of the year was 700,000 transplants, valued at £1,400, and 210 lbs. of seed, value £52; total, £1,452.

Sylvicultural Notes.—At the Mtao Forest Reserve new species are constantly being tested, and among the older planted trees many have shown themselves well adapted to the locality and able to withstand frost and drought. Trees which have been outstandingly successful are *Euc. punctata*, *E. resinifera*, *E. saligna*, *E. botryoides*, *Pinus insignis*, *P. pinaster*, *P. muricata*, *Cupressus lusitanica* and *Cup. torulosa*.

At the Stapleford Reserve *Eucalyptus saligna*, *E. botryoides* and *E. microcorys* are all thriving, many of them over 100 feet in height.

Cupressus lusitanica, *C. torulosa*, *P. insignis* and *P. patula*, seven years old and more, are showing excellent growth. *Populus alba* and the wattle *Acacia mollissima* are also well suited to the locality.

The droughts experienced throughout the country during the last two years have given ample foundation to the warnings issued by the Forest Service that tree planting on shallow soil invariably leads to failure.

The past dry season and the drought at the beginning of the present rainy season have left their mark in a very conspicuous manner in plantations of trees up to 15 years of age. Even the indigenous forests which exist on shallow soils show many dead or dying trees.

Exploitation.—At the Forest Nursery 76.5 cubic feet of timber was disposed of. The timber was mainly in the form of poles for wireless masts.

In the Kalahari Sand Forests exploitation of Rhodesian teak, mahogany and bloodwood continues to be carried out by concessionaires, who are responsible to the Department of Lands for royalty.

During the year four stationary and two portable sawmills were in operation, and it is probable that their output was in the neighbourhood of 350,000 cubic feet of sawn timber.

One firm of concessionaires went into voluntary liquidation.

Roads.—All roads and paths of the Mtao Reserve were kept in repair. At the Stapleford Forest Reserve the main road to Penhalonga was repaired in very bad places. Within the Reserve itself 11.8 miles of bridle paths were surveyed and constructed.

Buildings.—At the Mtao Reserve buildings were kept in repair; additions to the Forester's quarters at the European Relief Works were effected and a new Foreman's cottage erected.

At the Stapleford Reserve existing buildings were kept in repair; two inspection huts and a native compound of fifteen huts were erected and a new house for the Forester partly completed.

In the Kalahari Sand Areas the resident officer lived in temporary huts, situated in the various working sections.

Revenue.—The total revenue, apart from that paid to the Lands Department, was as follows:—

Forest Nursery, Salisbury	£2,281 15 10
Mtao Forest Reserve	265 4 10
Stapleford Forest Reserve	38 12 0
Total	£2,585 12 8

Expenditure.—The following table shows the expenditure incurred during the year, apart from salaries and allowances:—

Mtao Forest Reserve	£1,588 10 0
European Relief Works at Mtao	4,373 14 4
Stapleford Forest Reserve	9,112 14 3
Protection Indigenous Forests	1,400 8 2
Forest Nursery, Salisbury	1,226 5 7
Total	£17,701 12 4

Administration.—The staff of the Forestry Branch comprises the following members:—1 Forest Officer, 4 Assistant Forest Officers, 4 Foresters, 1 Assistant Forester, 1 Overseer, 1 Technical Clerk.

Private Forests.—It is gratifying to record that the year under review showed a still greater interest in forestry matters on the part of private individuals than ever before, so much so that the staff at head office was not in a position to cope with all the demands for visits and practical advice.

A noteworthy event of the year was the formation of a Rhodesian Arboricultural Society, which aims at stimulating interest in all matters pertaining to forestry, and, as a means to that end, organising tree-planting competitions.

Statistics published during the year are a remarkable proof that the realisation of the importance of tree planting is being felt by the farming community. The figures point out that the 1926-27 season showed the total area of trees planted by farmers to be 8,516 acres, or a 70 per cent. increase over the previous season.

At least one influential company started afforestation operations on a large scale, while negotiations are proceeding to acquire land in the wet zone of the eastern border with the same object in view.

It is of interest that the wattles of the Rhodes Inyanga Estate are being exploited for the first time and that the bark has proved to be of first quality.

Forest Officers, apart from their administrative duties in connection with State forests, were kept very busy with visits of inspection to farms and native reserves, with lectures to Farmers' Associations and with correspondence giving professional advice.

The publications during the year were:—Bulletin on "Charcoal in S. Rhodesia," by T. L. Wilkinson, in the *Rhodesia Agricultural Journal.*

In March the Forest Officer delivered a short paper on "Fuel Supplies of S. Rhodesia" to the Rhodesia Scientific Association.

In June the Forest Officer, as President of Section C at the Annual Conference of the South African Association for the Advancement of Science, held

in Kimberley, gave as his presidential address a paper on "The Relation of Water Supply to Vegetation in Southern Rhodesia."

The paper provoked great interest, and as a result the Conference requested the Government to allow facilities to the Forest Officer to prepare an ecological map of the Colony. The Government readily acceded to the request, and the Forest Officer is now engaged on the project.

Two articles prepared by the Forest Officers appeared in the public Press, as well as several references in the editorial columns to the importance of forestry.

The Forest Officer is glad to record his appreciation of the very willing co-operation of his officers and foresters in the efficient carrying out of the year's work.

J. S. HENKEL,
Forest Officer.

Annexure "J."

Report of the Irrigation Engineer for the Year 1928.

I have the honour to submit the annual report on the work performed by the Irrigation Branch.

The year under review has been one of expansion in all directions, and a further large increase in the demands made upon the staff of this Branch has been experienced.

In general the work of the Branch has been of a varied nature, such matters as irrigation, water supplies installations, water boring, soil erosion work and general engineering connected with agricultural activities having been dealt with.

The summary below gives the expenditure controlled and administered and the estimates of further expenditure dealt with during the twelve months in respect of work performed for this and other departments, exclusive of ordinary advisory work:—

General boring operations	£13,716 0 0
Purchase of drills	4,845 0 0
Development and installation of water supplies in native reserves	8,967 0 0
Water supplies, Limpopo stock route	1,104 0 0
Installation water supplies, Government institutions and townships	1,950 0 0
Engineering works for Agricultural Department	1,040 0 0
Surveys and estimates for water supplies, Government institutions	8,530 0 0
Hydrography and meteorology	651 0 0
Surveys and estimates for works for Agricultural Department	2,315 0 0
	£43,118 0 0

These matters will be dealt with more fully in the various sections following on.

Engineering Advice to Farmers and Others.—A further increase in the demand made by farmers and others for engineering assistance and advice has occurred this year.

As in the past, the information sought has been of a diverse nature relating to such subjects as the construction of general farm buildings, dipping tanks, well sinking, water supplies, electric power and lighting equipment, agricultural machinery and labour-saving devices and the use of explosives, in addition to surveys and reports on irrigation, water power schemes and soil erosion.

The following summary shows the number of visits paid to farmers in connection with advice on these matters, together with the total of new land reported as irrigable:—

Number of farms visited	201
Acreage of new irrigable land investigated	3,300
Total acreage of irrigable land investigated to the end of 1928	50,198

In addition to the above, addresses on soil erosion, small irrigation schemes and water supplies were delivered before seven meetings of farmers. Three

lectures were also given to the apprentices at the Tobacco Experiment Station on building construction and soil erosion.

Plans and estimates were prepared in connection with the construction of farm buildings at the Gwebi Farm and Matopos Farm, and advice given to the Curator, Matopos Estates, on various engineering matters.

The supply of engines for operating agricultural machinery at both Gwebi and Matopos Farms was also attended to by this Branch.

Surveys and estimates were prepared in connection with 24 water supply installations for Government institutions and small townships, and of this number a total of 14 of these schemes were actually carried out, the majority of the remainder being in hand at the moment.

Numerous queries have been received on the subject of tractors, and have been replied to as satisfactorily as the limited knowledge of this type of machinery under local conditions has permitted.

Four tractor demonstrations have been attended by members of the staff, one of these demonstrations being held at the Gwebi Farm. This latter was the trial and demonstration of two tractors, one fitted with suction gas producer plant, and the other operated by paraffin. It is hoped that comprehensive trials of tractors of different makes and running on different fuels will be carried out shortly. The data available from such trials will be of great value to the farming community of the Colony.

The number of farms visited this year is 201; an increase of four over the corresponding number for 1927.

With the existing staff of the Branch it has been found impossible to increase the number of visits, and a total of two hundred must be considered the approximate maximum per annum. There are 22 outstanding applications for visits which have not been attended to.

Special Reports and Investigations.—A cursory examination of the possibilities of water power on the Pungwe River at the Falls, distant about 14 miles from the Rhodes Inyanga Estate homestead, was carried out. The examination showed that a fall of about 900 feet could be made use of, and with the normal flow of the river about 1,800 horse power could be developed. The cost of the scheme was not gone into, but the engineering aspect appeared very favourable.

Further experiments in connection with fuel economy in tobacco barns were carried out at the Tobacco Experiment Station at the beginning of the year.

The Limpopo stock route was inspected and reported upon in connection with the provision of further water supply installations.

A special report was written by the Irrigation Engineer on "The Conservation of Water in Matabeleland."

A special report on "Water Boring" was sent to the Chief Engineer, Tanganyika Railways, and another on the same matter to the Director of Geological Survey, Tanganyika Territory.

Publications.—During the year the following articles were issued for publication by members of this Branch:—

In the *Rhodesia Agricultural Journal*—

"The Water Act, 1927," by C. L. Robertson, B.A., B.Sc. (Eng.), A.M.I.C.E.

"Irrigation Canals," "The Use of Explosives on the Farm," "Soil Erosion," by P. H. Haviland, B.Sc. (Eng.).

"The Time and How to Find It," by N. P. Sellick, M.C., B.Sc. (Eng.).

"Dairy Buildings in Southern Rhodesia" (2 Bulletins), by B. G. Gundry, A.I.Mech.E.

In the *Journal of the S.A. Institution of Engineers*—

Contribution by P. H. Haviland, B.Sc. (Eng.), to discussion on a paper on "Soil Erosion and its Prevention."

Rainfall returns and notes on the weather of the preceding month are published monthly in the *Rhodesia Agricultural Journal* and re-issued as a separate bulletin for distribution to meteorological institutions.

The Annual Meteorological Report for 1926-27 and the Hydrographic Report for 1925-26 and 1926-27 was issued as a Blue Book.

Irrigation.—The majority of irrigation schemes advised and reported on during the year under review have again been for small areas intended to be utilised as an adjunct to mixed farming.

The total acreage of new irrigable land investigated this year shows an increase of approximately 10 per cent. over that investigated during the previous year.

The Odzi Farmers' Association had previously requested that a preliminary survey should be undertaken to determine the approximate cost of a diversion scheme for the irrigation of land on the right bank of the Odzi River. This survey was carried out and the report submitted to that association, which decided that the costs of the whole or portion of the scheme were too high for the farmers themselves to finance the work.

The following summary gives the estimated costs of irrigating different acreages under this scheme:—

Irrigable acreage	Total cost.	Cost per acre	No. of farms
	£ s. d.	£ s. d.	
A. 487 acres ...	1,980 0 0	4 1 6	1
B. 1,330 „ ...	7,275 0 0	5 9 0	6
C. 1,590 „ ...	12,716 0 0	8 0 0	8
D. 2,225 „ ...	21,405 0 0	9 12 0	13

The results of the survey were disappointing, as the cost per acre irrigated increased with the increase in the total area irrigated—a most unusual feature of the cost of irrigation schemes. It is considered, however, that at the present a capital of £10 per acre irrigated is not an uneconomically high figure if small acreages per farm are utilised in connection with cattle fattening and dairy purposes.

A marked increase in interest in irrigation has been displayed by farmers this year, the fact being recognised that irrigation is a necessary adjunct to mixed farming.

Further development has taken place in the utilisation of existing irrigation facilities to permit of the early planting of summer crops.

At the request of the Chief Native Commissioner a preliminary investigation was made of the irrigable possibilities in the Mutema Native Reserve from the Tanganda River. This work was undertaken in May, and the results showed that an area of at least 100 acres of suitable soil could be commanded, but that a detailed survey would be necessary. It is intended to carry out this work early in the coming winter.

Soil Erosion.—The requests for advice on this subject are increasing annually, and interest is being displayed over a greater area of the Colony than hitherto. Advice has been given to farmers in Mazoe, Lomagundi, Hartley, Gwelo, Selukwe, Marandellas, Makoni, Umtali and Nyamandhlovu districts, but it is still mainly the farmers in the Mazoe district who are putting into practice the soil erosion protective measures advocated by this Branch, although Lomagundi district is also now taking practical steps to prevent the evil.

The number of visits to farms on soil erosion matters totalled 53 this year, as against a total of 60 last year, but there has been a marked increase in the number of farmers who have carried out the work wholly on their own, after receiving advice by letter or in the office from the members of the Branch.

The subject of soil erosion is receiving a great deal of attention in other countries, and it is of interest to note that a paper on "Soil Erosion and its Prevention" was read this year before the South African Institution of Engineers. In this paper it was stated that "Rhodesia is a notable example of practical attempts on scientific lines to prevent both erosion and denudation."

Further samples of river water have been and are still being collected during the flood season for the determination of silt contents of rivers. The data will be of great value in connection with storage dam design and as indications of the damage wrought by soil erosion.

Boring in Native Reserves, Crown Lands, Farms, etc.—Two additional drills have been brought into operation during the year, making a total of thirteen machines engaged in boring work in the Colony. One of the new machines is of the ordinary Departmental combined percussion-rotary type; the other is a rotary machine only, and was purchased for the purpose of prospecting for the Mines Department.

The attached schedule indicates the extent of boring operations during the past twelve months for Drills Nos. 7, 8, 9, 10, 12 and 13 for respective periods as stated in the "Remarks" column of the schedule.

The reason for giving details of drills for periods extending back for more than the past twelve months is that the cost of operation of machines when first placed in the field is higher than the cost when operations are being carried out normally. This method also permits of a true balance being struck between revenue and expenditure figures.

The following summary gives the total footage drilled, cost per foot, etc., for all machines except Nos. 1, 2 and 3 operating in native reserves, and No. 12 prospecting for Mines Department, for the year under review:—

Total depth drilled	11,234 feet
Footage drilled per working month per drill	112 ,,
Number of boreholes sunk	94
Average depth per borehole	119 feet
Number of successful boreholes	64
Percentage of successful boreholes	68%
Aggregate yield from successful boreholes	1,125,940 gallons per 24 hours
Number of Government farms on which successful supplies developed	40
Number of private farms on which successful supplies developed	15
Number of Government institutions on which successful supplies developed	3
Average cost per foot, including casing (all boreholes)	26s. 10d.

Note.—The aggregate yield from successful boreholes is on the conservative side, as the testing pumps were of a limited capacity.

The increase of 10d. in the average cost per foot for all boreholes is due to the scattered nature of the areas operated in by Drills Nos. 7 and 8, and also the high cost of operating No. 12, the drill used for prospecting work.

The percentage of successes is practically the same as was obtained during 1927. When the difficult nature of the geological formations met with in this Colony are taken into account, a percentage of successes between 60 per cent. and 70 per cent. is considered good.

The following summary gives the allocation of boreholes drilled by various machines other than those operating in native reserves for the year under review:

Drill No.	No. of boreholes sunk	No. of successful boreholes
4	6	1
5	15	12
6	16	13
7	12	9
8	12	7
9	12	8
10	11	6
11	6	4
12	1	1
13	3	3
Total ...	94	64

Below are given details of the work performed during the year by each of Drills Nos. 4, 5, 6, 7, 8, 9, 10, 11, 12 and 13:—

Drill No. 4.—This drill operated in the Trelawney area, where the results were very disappointing, only one borehole out of a total of six drilled proving successful.

There is no indication of the presence of dykes, which might account for the failure to obtain water supplies, and the reason for failure is obscure. The granite drilled appears to be of a similar nature and character to that encountered in the western Umvukwe area, where good results were obtained.

Drill No. 5.—The results obtained by this machine in the Tyne Mine area east of Hartley have been very good, the igneous rock on the edge of the Great Dyke yielding abundant supplies of water. Three boreholes were sunk in the granite in this area, but the supplies obtained in this formation were inadequate.

Boring has been instrumental in opening up this area to settlement, as there is a total absence of surface water during the dry season.

The boring costs are very low when it is realised that the presence of highly dipping schist necessitated the greater portion of the work being carried out with the rotary attachment.

Drill No. 6.—This machine was occupied in sinking boreholes in the Gadzema area, where good results were also obtained. Two of the failures were due to the fact that boreholes were sunk, at the urgent request of the Lands Department, for settlers on sites close to the homesteads concerned, the work being carried out before the selection of suitable sites could be made by the Boring Superintendent. Later, after selection of favourable sites, good supplies were developed on each farm at points more favourably situated for agricultural operations than the original sites bored on.

The boring costs in this area have been very reasonable.

Drill No. 7.—Work was performed by this drill in the Bulawayo, Bubi and Nyamandhlovu districts. The working period under review on the attached schedule is 21 months, this being given on account of the fact that the revenue earned during the short period when the machine operated last year was not sufficient to cover the high initial costs of operation plus depreciation.

The results obtained have been fairly satisfactory. The high cost of drilling at Government institutions and on Government farms is due to the heavy railage and transport expenses incurred, owing to the localities in which boring took place being long distances apart.

The cost of boring for private applicants is, on the other hand, extremely low, the average cost being 21s. per foot, with a maximum and minimum of 28s. 9d. and 8s. 4d. per foot respectively.

Drill No. 8.—The period under review for this drill, operating in the Banket and Salisbury areas, is 17 months, this being adopted for similar reasons as those given for the period under review for Drill No. 7.

The bulk of the work has been carried out in hard and difficult formations.

When operating on Government farms the price paid for transport, owing to shortage of grazing, was high. The cost of drilling for private applicants is very reasonable when the formation drilled in is considered.

The maximum cost of 36s. 8d. shown on the schedule is for a borehole put down for the Imperial Tobacco Company at Msasa Siding, where solid granite was drilled through to a depth of 110 feet before water was struck. The quantity of water obtained at this depth was tested to a yield of 2,000 gallons per hour.

Drill No. 9.—This drill operated in the Mazoe district for Government institutions and for private applicants. The average cost of 21s. 8d. per foot to private applicants is very low and has proved to be much less costly than well sinking. Previous to boring, several of the applicants had attempted to obtain water by well sinking, which cost nearly £3 per foot, and in some cases the rock at depth proved to be so hard that the cost of well sinking was prohibitive.

The high cost of the borehole sunk at Amandas for Government institutions was due to heavy transport and fuel charges.

Boring in this area has proved that the quartzites do not carry good supplies of water, and drilling had to be confined to the more fissured belts of schist.

Drill No. 10.—Operations were carried out by this machine in the Western Umvukwe area. This area has presented great difficulties in locating suitable boring sites, owing to the existence of many dolerite dykes which, as a rule, are not visible when the ground is covered with grass. In one instance a borehole was sunk to a depth of 170 feet, and yielded only 50 gallons per hour. A grass fire rendered visible the outcrop of a dyke, and on moving the machine a distance of only about 200 yards, a second borehole yielding a large supply of water was sunk, the water being obtained between 50 and 100 feet below the surface.

Transport charges were high and operations were suspended for two months, owing to the lack of grazing. The twelve months' working includes November and December, 1927. The high cost of drilling is due to the transport charges.

Drill No. 11.—This machine was occupied in sinking boreholes on Government farms in the West Nicholson area. The area is a difficult one in which to locate water, and consequently the number of failures is not unduly high.

Drill No. 12.—This machine was purchased for prospecting work for the Mines Department, and as the drill is purely of a rotary type, the cost per foot drilled is high; a percussion machine cannot be used for prospecting work. The high cost per foot is due also to the hard nature of the acid granite drilled through at the Seigneury Mine. On this property a 4 feet 6 inches wide reef of quartz was struck, yielding on assay 9.7 dwts. per ton. This property is now being developed.

Drill No. 12 is now engaged in deepening several boreholes for the Gatooma Municipality.

As this machine has operated for only four months, no balance has been struck between revenue and expenditure figures, as figures obtained after such a short period would be misleading.

Drill No. 13.—This machine is also new and has operated for only four months. Three successful supplies have been developed by this drill on Government farms in the Inyanda Block, Victoria district.

The cost per foot is high, owing to the high initial cost incurred in operating a new machine. The formation was hard and difficult to drill, and this is also reflected in the cost per foot.

The drill, at the present time, is engaged in sinking a borehole at Chibi, where the water shortage is very serious. On completion of this work the drill will be moved back to the Inyanda Block.

Drills Nos. 1, 2 and 3 operated in the Raditladi's, Mphoeng's, Gwaai and Shangani Reserves, the following summary showing the results of operations:—

Total depth drilled	4,240 feet
Number of boreholes sunk	25
Average depth per borehole	169.6 feet
Number of successful boreholes	14
Percentage of successful boreholes	56%
Aggregate yield from successful boreholes	99,840 gallons per 24 hours

Average cost per foot:—

Raditladi's and Mphoeng's	47s. 2d.
Gwaai	25s. 11d.
Shangani	21s. 2d.

The low percentage of successes is due to the fact that all eight boreholes put down in the Raditladi's and Mphoeng's Reserves were failures. The percentage of successes for the remainder is 82 per cent.

The high cost of drilling in the same reserves is accounted for by the fact that the drought conditions occasioned by the shortage of rains during the past two years necessitated the purchase of maize at a high price for feeding the transport animals and the purchase of donkeys to replace oxen which were dying from poverty.

Further details of water boring operations in Native Reserves are given in the appendix to the Annual Report of the Chief Native Commissioner.

On the whole, the results of water boring operations for the year under review have been very satisfactory, and the credit for this must be given to the staff engaged in the work.

Both the Boring Superintendent and the Boring Inspector have been unsparing in supervising the work, and the drill personnel have carried out their duties in an efficient and conscientious manner, except in two cases, both of which have been dealt with.

Special credit is due to Drill Foreman Life for the reduction of boring costs in the Gwaai Reserve, as he was called upon to exercise the greatest care and skill in sinking, among other boreholes, one to a depth of 620 feet with an obsolete No. 19 Star drill purchased at second-hand from the Union Government in 1922.

The staff of the boring section during the past twelve months consisted of the Boring Superintendent, a Boring Inspector, 12 Drill Foremen and three Assistant Drill Foremen.

For drills Nos. 4, 5, 6, 8, 9, 10 and 11 the revenue earned by each has been sufficient to cover working costs plus depreciation.

The earnings for drill No. 7 have not wholly covered working costs and full depreciation, this being due to time lost in transporting the plant by rail and road necessitated by the scattered locations of the properties operated on.

Water Supplies, Native Reserves.—In addition to the water boring operations in the Native Reserves, windmills, tanks and troughs have been installed at a number of the permanent supplies thus developed in the Shangani, Gwanda and Gwaai Reserves at a cost of £8,967.

Certain replacements of worn out equipment were necessary in the Gwaai Reserve.

Further hand-pumping attachments, which may be operated without disconnecting from the windmills, have been installed, but in some cases have been reported as being unsatisfactory. Investigation into this has proved that there is room for much improvement in the design, and the matter is being dealt with at the present time, further designs being examined and tested. It is anticipated

that a more satisfactory hand-pumping attachment will be available for installation next year.

Further details of the work performed is dealt with in the appendix to the Annual Report of the Chief Native Commissioner.

Water Supply Installation for Government Institutions and Townships.—During the year a number of water supply schemes for Government institutions were investigated and reported on. Estimates were prepared and the construction supervised of such schemes as were proceeded with, an amount of about £1,950 being expended to date.

Works have been carried out and supervised at Plumtree, Sinoia, Chibi, Bulawayo Government House, Fort Usher, Enkeldoorn, Hartley, Selukwe, Norton, Salisbury, Mtoko, Gwanda, Forest Nursery (Salisbury) and Domboshawa.

Reports and estimates were also prepared for water supply installations at Salisbury Hospital, Enkeldoorn, Sinoia, Bindura, Shabani Township, Chibi, Concession, Gwanda and Limpopo Township, and many of these schemes are in hand at the present time. Reports were written in connection with the raising of loans for Umvuma Town Management Board and Umtali Municipality.

Meteorology.—The work of the meteorological and hydrographic sections is supervised by the Assistant Hydrographic Engineer. The routine work consists of the classification of data, obtained from local observers, relating to the rainfall and climatic conditions of the Colony.

The change in the number of reporting stations during the year is shown in the following summary:—

	1927.	1928.
Stations with automatic instruments	3	3
Barometric stations	8	9
Thermometric stations	41	45
Rainfall stations	492	504
Total	542	561

The data obtained are checked and tabulated in a convenient form for general information and scientific purposes.

The regular information published during the year consists of the following:

(a) An Annual Meteorological Report.
(b) A monthly Weather Report in the *Agricultural Journal*.
(c) A weekly summary of rainfall.
(d) A daily Weather Report and Future Outlook is issued during the rainy season and telegraphed to 37 centres for distribution.
(e) Daily records from five barometric stations are sent monthly to Kew.
(f) A summary of our mean seasonal rainfall and deviation from normal is sent to the Indian Meteorological Department in April. This information is utilised for the forecast of the Indian monsoon rainfall.

Numerous enquiries of a varied nature relating to meteorology were dealt with during the year. The chapter on Meteorology in the Year Book was entirely re-written and illustrated with maps.

The Assistant Hydrographic Engineer visited the Meteorological Office at Pretoria while on leave. This visit was not only extremely useful in enabling much valuable information to be obtained from informal discussions with the staff at that office, but has since led to the institution of pilot balloon observations at Salisbury. Thanks are due to the Union Government officials for the assistance given by them in this matter.

The Meteorological Observatory at Beira was also visited by the Assistant Hydrographic Engineer.

Seasonal Forecast.—Little further progress has been made in the seasonal forecast work. In an endeavour to improve the forecast two new regression equations were formed incorporating South American factors. It is probable that these equations would give a slightly improved forecast. No considerable progress can be expected in this work until exhaustive investigations are made.

The forecast for the season 1927-28 was issued on the 14th November, 1927, and indicated a season 0.7 inch under normal. The actual deviation amounted to 5.6 inches under normal.

Daily Forecasts.—The daily forecasts were issued as usual. Several new centres have been added to the list of those receiving the forecast.

A new departure has been made in the Weather Maps. Pressures are now reduced to 1,500 metres instead of sea level. A considerable amount of work has been done in classifying the weather into types. The whole of the existing records have now been incorporated. The work has not yet been completed.

Hydrographic.—The routine work of this section comprises the collection of data relating to the storm and winter flow conditions of the chief rivers of the Colony.

The data is studied in conjunction with the rainfall and physical conditions of the catchments with a view to supplying reliable information regarding the potentialities of the different river systems for irrigation, water supply and power purposes. The value of extensive records of this nature will be fully appreciated in the future. At the present time the data available is very limited, and at the present time the call for this type of information in connection with the administration of the Water Ordinance is much in excess of what can be supplied.

The futility of designing and carrying out expensive irrigation schemes without comprehensive hydrographic data is at the moment being fully realised in the Union of South Africa.

It is considered that further extension of this work will be necessary in the very near future.

The hydrographic information is obtained by means of:—

(a) Automatic recording instruments at gauging weirs and dams.
(b) Daily records of river level by local observers.
(c) Individual gaugings by members of the engineering staff when on tour.

Additional gauging stations, equipped with automatic instruments, were opened at Fort Victoria on the Umshagashi River and at Bulawayo on the Khami River.

Water Ordinance.—A considerable time was spent by the Irrigation Engineer on the drafting of the regulations under the Water Ordinance, for combined irrigation schemes. These regulations have now been issued as a Government Notice.

During the period under review the Irrigation Engineer sat as Engineering Assessor on five Water Courts for the consideration of various applications in Belingwe, Gwelo, Hartley, Lomagundi, Makoni, Marandellas, Mazoe, Salisbury, Sebungwe, Victoria and Umtali districts.

In all, 38 days were occupied by this officer on Water Court duties.

The Assistant Hydrographic Engineer reported on 43 water right applications. The reports submitted dealt with the river system affected, water available for apportionment and effect of the proposed applications on the existing rights.

The total acreage for the irrigation of which authorities were granted was 273 acres.

Seven applications for tertiary use were granted; seven applications for the use of water for mining purposes were granted; one application was granted for the development of power for mining purposes and one for the use of water for railway purposes.

Fifteen other miscellaneous applications and other matters were dealt with.

Staff.—The staff was practically at full strength during the year, with the exception of absence due to vacation and sick leave.

Acknowledgment is made of the loyal services rendered by the whole staff of this Branch during the year.

P. H. HAVILAND,
Acting Irrigation Engineer.

SCHEDULE OF BORING OPERATIONS FOR 1927-1928 FOR DRILLS OPERATING UNDER LOAN VOTE IN NATIVE RESERVES.

Drill Nos.	Areas	Formations	No. of boreholes sunk	Total depth bored in feet	Total No. of successful boreholes	Total supply in gallons per 24 hours	Average cost per foot	Remarks
1	Raditladi's and Mphoeng's Reserves	Granite	8	738	...	...	47/2	One borehole in progress.
2	Gwaai Reserve	Kalahari beds, basalt, Karroo sandstone	5	1,341	3	33,600	25/11	One borehole in progress.
3	Shangani Reserve	Running sands, sandstone, granite, schist	12	2,161	11	66,240	21/2	The borehole shown as unsuccessful is one which was not completed, as the drill had to be moved to meet the urgent need of water in another part of the reserve. This hole can be continued later.

SCHEDULE OF BORING OPERATIONS FOR 1927-1928 FOR

Drill No.	Areas	Formations	No. of boreholes	Total depth bored in feet	Total No. of successful boreholes	Total supply in gallons per 24 hours
4	Trelawney, Lomagundi	Granite	6	757	1	12,000
5	Tyne Mine Area, Hartley	Schist and granite	14 1	1,607 108	11 1	216,680
6	Gadzema Area, Hartley	Granite	14 2	1,400 206	11 2	272,472
7	Bulalima-Mangwe, Bulawayo, Bubi, Nyamandhlovu	Granite, schist, basalt, sandstone, quicksands	6 13	637 1,662	3 9	134,080
8	Banket and Salisbury	Granite, quartzite, diorite	10 8	870 1,016	6 5	163,960
9	Mazoe Valley	Quartzite and schist	1 16	108 1,745	1 10	246,880
10	Western Umvukwes, Lomagundi	Granite	13	1,348	8	184,300
11	West Nicholson	Granite, quartz, hornblende, schist	6	1,050	4	40,560
12	Seigneury Drift, Hartley	Granite, dolerite, quartz, quartzite	1	386	1	Payable reef struck
13	Inyanda Block, Victoria District	Granite, quartz, hornblende, schist	3	296½	3	32,400

DRILLS OPERATING UNDER REVENUE VOTE.

Average cost per foot, including casing	Maximum cost per foot, including casing	Minimum cost per foot, including casing	Remarks.
38/8	43/10	29/8	Boring on Government farms. Transport supplied by Government, cost being included. Working period 11 months.
22/2	37/4	16/4	14 Boreholes drilled on Government farms. Transport supplied by Government, cost being included.
13/-	13/-	13/-	1 Borehole drilled for private applicant, who supplied own transport. Working period 12 months.
22/9	31/4	14/10	14 Boreholes drilled on Government farms. Transport supplied by Government, cost being added.
16/5	28/-	11/-	2 Boreholes drilled for private applicants, who supplied own transport.
37/1	42/4	30/1	6 Boreholes drilled for Government institutions and 2 Government farms. Transport supplied by Government, cost being included.
21/-	28/9	8/4	13 Boreholes drilled for private applicants, who supplied their own transport. Working period 21 months.
29/8	45/5	16/7	10 Boreholes drilled on Government farms. Transport supplied by Government, cost being included.
22/8	36/8	10/4	8 Boreholes drilled for applicants, who supplied their own transport. Working period 17 months.
29/1	29/1	29/1	1 Borehole drilled for Government institution. Transport supplied by Government, cost being included.
21/8	35/4	10/6	16 Boreholes drilled for applicants, who supplied their own transport. Working period 15 months.
29/9	41/4	20/2	13 Boreholes drilled on Government farms. Transport supplied by Government, cost being included. Working period 12 months.
37/5	39/10	35/2	6 Boreholes drilled on Government farms. Transport supplied by Government, cost being included. Working period 12 months.
49/1	49/1	49/1	Mining drill. Transport supplied by Government, cost being included. Working period 4 months.
37/4	41/8	33/2	3 Boreholes drilled on Government farms. Transport supplied by Government, cost being included. Working period 4 months.

Annexure "K."

Report of the Chief Botanist and Mycologist for the Year 1928.

General.—This year was marked by the transfer of headquarters to the new building, which has been erected at the Salisbury Experiment Station. The improved facilities afforded by up-to-date accommodation and the close proximity to experimental plots have made it possible to embark upon work which heretofore could not be attempted. It has also been possible to establish a closer liaison with the other technical branches, whose co-operation has been most helpful. Towards the end of the year the two sections of Botany and Mycology were merged into one Division, and botanical work—which had been in abeyance since the retirement of Mr. Eyles in March—was recommenced by the newly appointed Botanist.

Diseases of tobacco again claimed a good deal of attention, and a much more thorough knowledge of local conditions has been obtained, which has facilitated the recommendation of control measures. As much of this information as possible has been communicated to tobacco growers through the medium of the *Rhodesia Agricultural Journal* and by personal demonstration, so that a greater interest in plant pathology is evident throughout the country. A more general knowledge of the losses incurred by diseases of crops has induced farmers to seek advice and experiment upon control measures, and a wide variety of matters has been broached in correspondence. Material of all the principal crops grown has been received, which has resulted in the listing of over fifty diseases of which there is no record in this country. Further to these, a number of organisms not mentioned in available literature have had to remain unnamed pending the confirmation of their pathenogenicity, no time being available for such experimental work owing to the great increase in routine work.

Three hundred and fifty-two lots of material have been received and reported upon during the year, whilst information and advice have been given by interviews and correspondence. Sixty-five farms have been visited, on a number of which demonstrations have been given to assembled farmers. Few farmers' meetings have been attended, since it is considered that demonstrations in the field are of more practical importance than lectures when dealing with diagnosis and control of plant diseases.

Publications.—The following articles have been written for the *Agricultural Journal*:—

"Mosaic Disease of Tobacco," February issue.

"Wildfire and Angular Spot of Tobacco," February issue.

"Frenching of Tobacco," May issue.

"Precautionary Measures against Tobacco Diseases," September and October issues.

"Preliminary Experiments on the Control of White Mould of Tobacco," December issue.

Tobacco.—The most destructive diseases occurring during the year were White Mould (*Erysiphe cichoracearum*), Frog Eye (*Cercospora nicotianae*), Red Rust (*Macrosporium alternaria longipes*) and Mosaic. Wildfire (*Bacterium tabacum*) and Angular Spot (*B. angulatum*) were widely distributed, but the dry climatic conditions prevented their extensive development. On the other hand, the drought experienced during February followed by heavy rains in March seriously delayed reaping, and resulted in heavy infection by fungus diseases on the prematurely ripe leaf. In some districts further loss was occasioned by incipient infections of the frog eye fungus developing rapidly in the early stages of curing, and producing serious black spotting. It was found, however, that this trouble could be overcome by ample ventilation of the barns at low temperatures.

A new leaf disease appeared in the Sinoia district which was attributable to an *Alternaria* sp. distinct from that causing red rust, but appeared to be confined to the heavier types of soil and usually followed heavy rain.

Observations made upon *Alternaria tenuis* (*Macrosporium tabacinum*) showed it to be very prevalent upon all kinds of dead or dying tissue. In two instances (which were confirmed in the laboratory) the organism was responsible for the death of germinating seedlings which had been allowed to become dry.

Investigations into the alleged ill effect upon germination of corrosive sublimate seed treatment confirmed the suspicion that in most cases the fault lay in seed bed cultural methods. In the majority of instances delayed germination could be attributed to lowering of soil temperature, due to excessive evaporation brought about by over-watering during the very hot, dry weather before the arrival of the rains. Uneven or low percentage germination was usually the result of the use of improperly winnowed seed. In all samples tested in the laboratory the large and heavy seed germinated well. Damping-off (*Rhizoctonia solani*) occurred in over-watered beds.

Mosaic was widely distributed during the 1927-28 season, but few heavily infected fields were seen. It was demonstrated on a number of farms that this disease can be adequately controlled by suitable rogueing; it is therefore surprising to note the very large increase in the amount of mosaic during the present season. There is little doubt that much infection is present in the seed beds, and in view of recent work in America it would appear that the use of snuff by native labourers should be strongly discouraged. The possibility of insect transmission of the virus is at present under investigation.

An obscure disease, often confused with mosaic and which has been called "Crinkle," has been produced experimentally, but data regarding the causes are not yet complete.

Citrus.—The gradual decline of two groves of orange trees which has been the subject of investigation for some time has been shown to be due to root disease caused by a strain of the fungus *Rhizoctonia bataticola* (*Macrophomina phaseoli*). The symptoms of disease are similar to those of *mal-di-gomma*, particularly in the cracking of bark at the collar, but control measures which are usually advocated for the latter have never been successfully applied in Rhodesia. The presence of root disease would account for this. Similar diseases associated with waterlogging and improper planting are thought to be distinct from that caused by *Rhizoctonia*, but further work is required on this important subject. One fact, however, is established—that good cultural methods will not "bring back" trees infected by *Rhizoctonia*.

Fruit diseases are generally of rare occurrence in the groves, "tear stain," with which is associated *Colletotrichum gloeosporioides*, being the only one of importance recorded.

Serious storage rot, caused by the blue-green mould *Penicillium italicum*, has been reported, and the exposure of spore traps in pack houses has shown a high percentage of spores of this fungus to be present in the wilting-rooms. The regular fumigation of pack houses with formalin is now being carried out on some estates.

Maize.—Little time has been available for work upon this crop, but although indefinite information only is at hand, there is no doubt that Dry Rot (*Diplodia zeae*) is widely distributed throughout the country and takes a heavy toll of the crop annually. Investigations are proceeding, and it is expected that measures will be devised for the rapid reduction of losses from this source, but the co-operation of the whole of the maize industry is required in order to obtain success.

Potatoes.—Early Blight (*Alternaria solani*) was universally present on all crops and undoubtedly appreciably reduces the yield throughout the Colony. Strongly growing plants resist the disease for as much as two or three weeks longer than the normal, whilst copper sprays and dusts give a certain amount of protection. Spraying and dusting trials have been commenced.

The internal browning of tubers, usually known as Brown Fleck, is of common occurrence and is correlated with sandy loams not rich in organic matter.

Black Scab (*Rhizoctonia solani*) appears to be of general distribution.

Certain "degeneration" diseases appear to be associated with storage conditions, and investigations have been commenced in co-operation with the Division of Entomology.

Other Crops.—The more important diseases include Flax Wilt (*Fusarium lini*), Tomato Leaf Spot (*Septoria lycopersici*) and Mould (*Cladosporium fulvum*) *B. phaseoli* on beans, *Erysiphe polygoni* on peas, *Rhizoctonia bataticola* on Eucalyptus, *Colletotrichum theae* on tea.

Field Experiments.—Preliminary experiments on the control of White Mould of tobacco by treating the soil with sulphur met with marked success, no infection appearing in plots receiving as little as 40 lbs. per acre. Control plots were infected normally. Further trials have been commenced on a larger scale this season.

Dusting with 20 per cent. copper-lime was found to give no control of Angular Spot, but distinct success was obtained by drastic priming to the bud about one month after planting out. Priming was continued at later stages up to eighteen inches from the ground level, and a marked diminution was observed in the incidence of White Mould.

Control of Septoria Leaf Spot of tomato, Bacterial Blight of beans and Anthracnose of grapes was obtained with copper-lime dust, grey blight of tea and Anthracnose of paw-paw were checked by Bordeaux spray, and powdery mildews of pumpkin (*Erysiphe cichoracearum*) and peas (*Erysiphe polygoni*) were controlled by dusting with sulphur.

Miscellaneous.—Two weeks were spent in company with the Chief Chemist and Tobacco Adviser on a visit to Nyasaland in order to discuss mutual problems connected with the tobacco industry, and a report has already been submitted.

For the first time Mycology was represented at the Salisbury Agricultural Show.

Botany.—Since the appointment of the Botanist about 250 plants have been collected from the Salisbury district. Of these, about one-half have been named, jacketed and added to the herbarium.

Identification of material submitted by various Government departments and by farmers has occupied a considerable amount of the Botanist's time, as the existing library and herbarium, since the removal of the Eyles collection, is quite inadequate for present needs. It is most desirable that this collection be acquired for the present herbarium in order to obviate the reduplication of work which has extended over the past 20 years.

Economic Botany.—*Wheat.*—A survey has been commenced of the wheats at present in the country and a number of foreign varieties obtained for hybridisation and selection. Plots have been laid out on the chess board system and are now ready for sowing. The principal object in view is the raising of a hard-grained, rust-resistant variety suitable for summer culture.

Maize.—Investigations have been commenced on the red pigments with a view to discovering the cause of "Pinking." Observations are also being kept upon the heritable characters of white maize.

In conclusion, I wish to express my appreciation of the assistance and co-operation of those officers of the Department upon whose provinces my work has encroached.

J. C. HOPKINS,
Chief Botanist and Mycologist.

Annexure "L."

Report of the Editor, "Rhodesia Agricultural Journal," for the Year 1928.

The *Rhodesia Agricultural Journal* has now completed twenty-five years of its career, during which period it has been published without a break. The *Journal* first appeared in August, 1903, as a bi-monthly publication, in which form it continued until June, 1925, since when it has been issued monthly. The mission of the *Journal* was well expressed in the first issue in the following words: "To form a bond between those whose concern it is that Rhodesian agriculture should receive all possible support, encouragement and advancement." This bond has been established, and through the medium of the *Journal* the the Government is able to give practical expression of its desire to uplift the farming industry.

During the year articles have been published on a wide variety of subjects covering almost every phase of Rhodesian agriculture, while an attempt has been made to keep readers informed of modern developments in agricultural practice. On occasions articles have been contributed by farmers having a good practical knowledge of a particular subject, and much useful information has been disseminated in this manner.

Bulletin reprints are made of all the principal articles which appear in the *Journal*, and these are distributed free to residents of Southern Rhodesia, a small charge being made to non-residents. This service is very popular, and a large number of bulletins have been sent out.

The number of subscribers continues to increase, and it is necessary to print 2,500 copies of the *Journal* monthly. Apart from residents of this Colony, there is an increasing list of subscribers in Northern Rhodesia, Nyasaland, Kenya, Portuguese East Africa and other parts of the Continent, many of whom have testified to the usefulness of the *Journal* in their farming operations.

The cost of printing the twelve issues of the *Journal* was £2,394 18s. 2d., and the revenue received from advertisements and subscriptions was £1,214 17s. 3d.

WILLIAM E. MEADE,
Editor.